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# PATENT ABSTRACTS OF JAPAN

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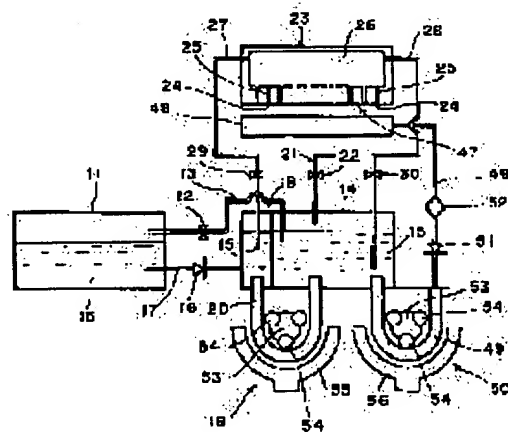
MUKASA MITSUHIRO

(54) IMAGE FORMING METHOD AND APPARATUS THEREFOR

(57)Abstract:

PROBLEM TO BE SOLVED: To prevent that a liquid is pushed out of the emitting orifices of a printing head and air is drawn in when an atmosphere communication passage and a liquid supply passage are changed from a closed state to an open state.

SOLUTION: In an image forming apparatus having supply passage opening and closing means 29, 30 capable of opening and closing the liquid supply passages 27, 28 allowing a printing head 23 emitting a liquid 15 to a printing medium to form an image to communicate with the tank 14 storing the liquid 15 supplied to the printing head 23, a communication passage opening and closing means 22 capable of opening and closing the atmosphere communication passage 21 allowing the tank 14 to communicate with the atmosphere and an opening and closing means driving means for opening and closing the supply passage opening and closing means 29, 30 and the communication passage opening and closing means 22, the opening and closing means driving means has a differential means performing the changeover of the atmosphere communication passage 21 from a closed state to an open state by the communication passage opening and closing means 22 prior to the changeover of the liquid supply passages 27, 28 from a closed state to an open state by the supply passage opening and closing means 29, 30.



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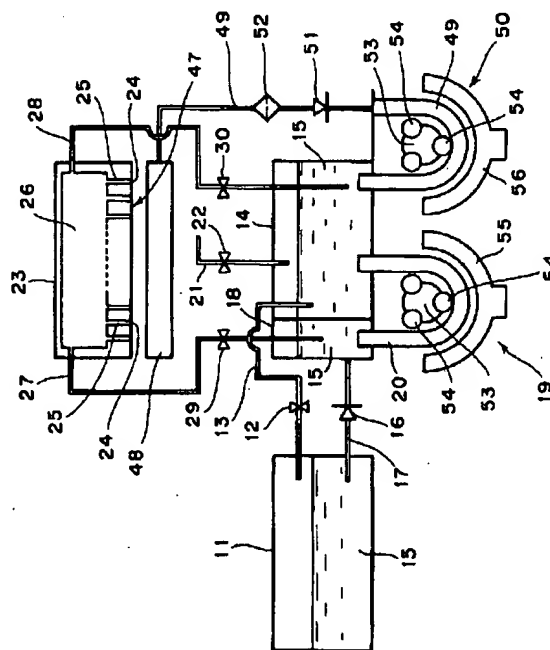
(74) 代理人 弁理士 谷 義一 (外1名)

(54) 【発明の名称】 画像形成方法およびその装置

(57) 【要約】

【課題】 大気連通路および液体供給通路を閉止状態から開放状態に切り換えると、プリントヘッドの吐出口から液体が押し出されたり、空気が引き込まれたりする。

【解決手段】 プリント媒体に液体15を吐出して画像を形成するためのプリントヘッド23とこのプリントヘッド23に供給される液体15を貯溜したタンク14とを連通する液体供給通路27、28を開閉可能な供給通路開閉手段29、30と、タンク14と大気とを連通する大気連通路21を開閉可能な連通路開閉手段22と、これら供給通路開閉手段29、30および連通路開閉手段22の開閉を行うための開閉手段駆動手段とを有する画像形成装置であって、開閉手段駆動手段は、供給通路開閉手段29、30による液体供給通路27、28の開状態から閉状態への切り換えに先立って連通路開閉手段22による大気連通路21の開状態から閉状態への切り換えが行われる差動手段を有する。



【特許請求の範囲】

【請求項1】 大気と連通する大気連通路が設けられたタンクから液体供給通路を介して供給される液体を吐出口から吐出するプリントヘッドを用いてプリント媒体に画像を形成する方法であって、

前記大気連通路および前記液体供給通路を共に閉鎖するステップと、  
この状態から前記大気連通路を最初に開放するステップと、  
前記大気連通路を開放した後に前記液体供給通路を開放するステップとを具えたことを特徴とする画像形成方法。

【請求項2】 前記大気連通路および前記液体供給通路を共に閉鎖するステップは、前記プリント媒体に画像が形成されない待機時および電源オフ時に実行されることを特徴とする請求項1に記載の画像形成方法。

【請求項3】 前記液体は、インクまたは前記プリント媒体に対するインクのプリント性を調整するための処理液であることを特徴とする請求項1または請求項2に記載の画像形成方法。

【請求項4】 プリント媒体に液体を吐出して画像を形成するためのプリントヘッドとこのプリントヘッドに供給される液体を貯留したタンクとを連通する液体供給通路を開閉可能な供給通路開閉手段と、前記タンクと大気とを連通する大気連通路を開閉可能な連通路開閉手段と、これら供給通路開閉手段および連通路開閉手段の開閉を行うための開閉手段駆動手段とを有する画像形成装置であって、  
前記開閉手段駆動手段は、前記供給通路開閉手段による前記液体供給通路の開状態から閉状態への切り換えに先立って前記連通路開閉手段による前記大気連通路の開状態から閉状態への切り換えが行われる差動手段を有することを特徴とする画像形成装置。

【請求項5】 前記差動手段は、カムを利用したものであることを特徴とする請求項4に記載の画像形成装置。

【請求項6】 プリント媒体に液体を吐出して画像を形成するためのプリントヘッドとこのプリントヘッドに供給される液体を貯留したタンクとを連通する液体供給通路を開閉可能な供給通路開閉手段と、この供給通路開閉手段の開閉を行うための第1の開閉手段駆動手段と、前記タンクと大気とを連通する大気連通路を開閉可能な連通路開閉手段と、この連通路開閉手段の開閉を行うための第2の開閉手段駆動手段とを有する画像形成装置であって、  
前記供給通路開閉手段による前記液体供給通路の開状態から閉状態への切り換えに先立って前記連通路開閉手段による前記大気連通路の開状態から閉状態への切り換えが行われるように前記第1および第2の開閉手段駆動手段の作動を制御する制御手段をさらに具えたことを特徴とする画像形成装置。

【請求項7】 前記連通路開閉手段および前記第1の開閉手段駆動手段がチューブポンプであることを特徴とする請求項6に記載の画像形成装置。

【請求項8】 前記プリントヘッドは、前記吐出口から液体を吐出するための吐出エネルギー発生部を有することを特徴とする請求項4から請求項7の何れかに記載の画像形成装置。

【請求項9】 前記吐出エネルギー発生部は、熱エネルギーを発生する電気熱変換体を有することを特徴とする請求項8に記載の画像形成装置。

【請求項10】 前記プリントヘッドの前記吐出口は、前記プリント媒体のプリント領域の全幅に亘って配列していることを特徴とする請求項4から請求項9の何れかに記載の画像形成装置。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、画像形成方法およびその装置に関し、特にインクジェット方式を用いたフルラインタイプのプリンタに応用して好適なものである。

【0002】

【従来の技術】インクや、このインクのプリント性を調整するための処理液などの液体をインクジェットヘッドの吐出口から吐出し、紙や樹脂フィルム、あるいは布帛や金属などのプリント媒体に所望の画像を形成するインクジェットプリンタは、プリントヘッドがこのようなプリント媒体に対して非接触であるため、静粛性に優れ、プリント速度が速く、高密度プリントが可能であってカラー化が容易であり、装置全体を小型化できるなどの利点を挙げることができる。

【0003】このようなインクジェットプリンタの一つとして、プリント媒体の画像形成領域の全幅に亘って吐出口を配列した長尺のいわゆるフルラインタイプのインクジェットヘッドを用いたものが知られている。このフルラインタイプのインクジェットヘッドにおいては、プリントヘッドがプリント媒体の幅方向に走査するいわゆるシリアルタイプのものと比較すると、インクの消費速度が早いことから、タンクに貯留された液体を少なくとも2箇所、例えば吐出口の配列方向に沿った共通液室の両端側から供給することが一般的となっており、これら供給通路にはインクジェットヘッドに対する液体の給排を制御するための開閉弁がそれぞれ介装されている。また、液体を貯留するタンクには、タンクから液体がインクジェットヘッドに供給されるに連れてタンク内が負圧となり、タンクからインクジェットヘッドへのインクの供給が阻害されることがないように、大気と連通する大気連通路が形成されており、この大気連通路にはタンクから不必要な水分の蒸発を抑制するための連通路開閉弁が介装されている。

【0004】かかる従来の開閉弁の開閉状態における概

略構造を図10に示し、その開弁状態における概略構造を図11に示す。すなわち、バッファタンク101およびサブタンク102の上端部には、出口ポート103が図示しないインクジェットヘッドの共通液室にそれぞれ連通する一対の供給通路開閉弁104、105と、出口ポート106が大気と連通する連通路開閉弁107とが設けられている。これら3つの開閉弁104、105、107の構造はすべて同一であり、弁体108と一体のプランジャ109が貫通する操作板110を複数（図示例では2つ）のカム軸111に取り付けられたカム112の回転によって昇降させ、通路113の開閉を一括して行うようになっている。

【0005】カム軸111は、図示しない1つの駆動源に連結され、カム112を図10に示す開弁位置と、図11に示す閉弁位置とにそれぞれ旋回駆動するようになっており、装置の電源をオフにした状態における非プリント作業時や、装置の電源をオンにした状態におけるプリント作業待機時などに通路113をそれぞれ閉鎖し、バッファタンク101およびサブタンク102からの液体の流動を防止している。

#### 【0006】

・【発明が解決しようとする課題】図10、図11に示した従来のものでは、図示しない交換可能なカートリッジからバッファタンク101およびサブタンク102に所定量の液体を補充する場合、上述した開閉弁104、105、107をすべて閉弁状態にして行っているため、液体の補充を終了してプリント作業に移行する場合、各開閉弁104、105、107を開弁状態に切り換えると、バッファタンク101内およびサブタンク102内の圧力が出口ポート103、106側の圧力、つまりインクジェットヘッドの共通液室内の圧力や大気圧に対して差圧が発生する場合がある。

【0007】このような差圧は、大気圧や気温などの変動の他に、カートリッジに貯留された液体の温度とインクジェットヘッドの共通液室内に充填された液体の温度とに差がある場合にも発生する。

【0008】同様に、開閉弁104、105、107を開弁状態に保持する非プリント作業状態から電源を投入した場合や、開閉弁104、105、107を開弁状態に保持しているプリント作業待機状態からプリント作業状態に移行する場合にも、開閉弁104、105、107が開弁状態に切り換えられるため、同様な差圧が発生することがある。

【0009】バッファタンク101内およびサブタンク102内の圧力が開閉弁104、105、107の出口ポート103、106側の圧力と相違すると、インクジェットヘッドの吐出口から液体が押し出され、これが吐出口面に付着してプリント媒体を汚したり、あるいはインクジェットヘッドの吐出口からインクジェットヘッド内に空気が引き込まれてしまい、吐出口から液体を正常

に吐出できなくなり、何れの場合もプリント品質の低下を招来する。

#### 【0010】

【発明の目的】本発明の目的は、プリントヘッドの吐出口から液体が押し出されたり、プリントヘッドの吐出口から空気が引き込まれたりすることがない画像形成方法およびその装置を提供することにある。

#### 【0011】

【課題を解決するための手段】本発明による第1の形態は、大気と連通する大気連通路が設けられたタンクから液体供給通路を介して供給される液体を吐出口から吐出するプリントヘッドを用いてプリント媒体に画像を形成する方法であって、前記大気連通路および前記液体供給通路を共に閉鎖するステップと、この状態から前記大気連通路を最初に開放するステップと、前記大気連通路を開放した後に前記液体供給通路を開放するステップとを具えたことを特徴とする画像形成方法にある。

【0012】また、本発明による第2の形態は、プリント媒体に液体を吐出して画像を形成するためのプリントヘッドとこのプリントヘッドに供給される液体を貯留したタンクとを連通する液体供給通路を開閉可能な供給通路開閉手段と、前記タンクと大気とを連通する大気連通路を開閉可能な連通路開閉手段と、これら供給通路開閉手段および連通路開閉手段の開閉を行うための開閉手段駆動手段とを有する画像形成装置であって、前記開閉手段駆動手段は、前記供給通路開閉手段による前記液体供給通路の開状態から閉状態への切り換えに先立って前記連通路開閉手段による前記大気連通路の開状態から閉状態への切り換えが行われる差動手段を有することを特徴とする画像形成装置にある。

【0013】本発明によると、開閉手段駆動手段により供給通路開閉手段および連通路開閉手段を操作して液体供給通路および大気連通路を共に閉鎖した状態から、再び開閉手段駆動手段により供給通路開閉手段および連通路開閉手段を逆に操作すると、差動手段によってまず連通路開閉手段による大気連通路の開状態から閉状態への切り換えが行われ、タンク内が大気連通状態となった状態で供給通路開閉手段による液体供給通路の開状態から閉状態への切り換えが行われる。

【0014】さらに、本発明による第3の形態は、プリント媒体に液体を吐出して画像を形成するためのプリントヘッドとこのプリントヘッドに供給される液体を貯留したタンクとを連通する液体供給通路を開閉可能な供給通路開閉手段と、この供給通路開閉手段の開閉を行うための第1の開閉手段駆動手段と、前記タンクと大気とを連通する大気連通路を開閉可能な連通路開閉手段と、この連通路開閉手段の開閉を行うための第2の開閉手段駆動手段とを有する画像形成装置であって、前記供給通路開閉手段による前記液体供給通路の開状態から閉状態への切り換えに先立って前記連通路開閉手段による前記大

気連通路の開状態から閉状態への切り換えが行われるように前記第1および第2の開閉手段駆動手段の作動を制御する制御手段をさらに具えたことを特徴とする画像形成装置にある。

【0015】本発明によると、第1および第2の開閉手段駆動手段により供給通路開閉手段および連通路開閉手段を操作して液体供給通路および大気連通路を共に閉鎖した状態から、制御装置によって再び第1および第2の開閉手段駆動手段により供給通路開閉手段および連通路開閉手段を操作すると、まず連通路開閉手段による大気連通路の開状態から閉状態への切り換えが行われ、タンク内が大気連通状態となった状態で供給通路開閉手段による液体供給通路の開状態から閉状態への切り換えが行われる。

【0016】

【発明の実施の形態】本発明の第1の形態による画像形成方法において、大気連通路および液体供給通路を共に閉鎖するステップは、プリント媒体に画像が形成されない待機時および電源オフ時に実行されるものであっても良い。また、液体は、インクまたはプリント媒体に対するインクのプリント性を調整するための処理液であっても良い。

【0017】本発明の第2の形態による画像形成装置において、差動手段は、カムを利用したものであっても良い。

【0018】本発明の第2および第3の形態による画像形成装置において、プリントヘッドは、吐出口から液体を吐出するための吐出エネルギー発生部を有するものであっても良く、この場合、吐出エネルギー発生部は、熱エネルギーを発生する電気熱変換体を有するものであっても良い。また、プリントヘッドの吐出口は、プリント媒体のプリント領域の全幅に亘って配列しているものであっても良い。

【0019】本発明の第3の形態による画像形成装置において、連通路開閉手段および第1の開閉手段駆動手段がチューブポンプであっても良い。

【0020】

【実施例】本発明による画像形成装置をフルラインタイプのインクジェットプリンタに応用した実施例について、図1～図9を参照しながら詳細に説明するが、本発明はこのような実施例に限らず、これらをさらに組み合わせたり、同様な課題を内包する他の分野の技術にも応用することができる。

【0021】第1の実施例におけるインク供給系を表す図1に示すように、交換可能に搭載されるインクカートリッジ11は、開閉弁12が途中に組み込まれたインク戻し管13を介してサブタンク14と連通し、また、このインクカートリッジ11側へのインク15の逆流を防止する逆止め弁16が途中に介装されたインク供給管17を介してバッファタンク18に連通している。このバ

ッファタンク18とサブタンク14とは、正逆転可能な第1のチューブポンプ19を途中に組み込んだインク給排管20を介して連通しており、この第1のチューブポンプ19の正転動作によってバッファタンク18内のインク15がサブタンク14側に圧送されるようになっていく。

【0022】上述した開閉弁12は、インクカートリッジ11の着脱操作に連動してインク戻し管13を自動的に開閉するものである。つまり、インクカートリッジ11がインクジェットプリンタから取り外されている状態では、開閉弁12が閉じてインク戻し管13を閉止しており、逆にインクカートリッジ11がインクジェットプリンタに取り付けられている状態では、開閉弁12が開いてインクカートリッジ11とサブタンク14とがインク戻し管13を介して連通するようになっている。

【0023】サブタンク14の上端部には、空気給排管21を介してサブタンク14内を大気連通可能な開閉弁22を有する。この開閉弁22は、インクカートリッジ11からサブタンク14にインク15を圧送する時およびこのインクジェットプリンタの不使用时、つまり保管時にはサブタンク14内を塞ぎ、サブタンク14からインク15中の水分の蒸発を防止するようにしている。

【0024】図示しないプリント媒体のプリント領域の全幅に亘って多数の吐出口24が配列する本実施例のインクジェットヘッド23は、いわゆるフルラインタイプのものであり、このインクジェットヘッド23の吐出口24と所定間隔を隔てて対向するように配置されるプリント媒体が図1の紙面に対して垂直な方向に搬送される間に、各吐出口24からインク15が吐出され、所望の画像がプリント媒体に形成されるようになっている。一端がそれぞれ吐出口24となったインク路25の他端は、このインクジェットヘッド23内に形成された共通インク室26に連通した状態となっており、この共通インク室26の一端側には、第1のインク循環供給管27を介してバッファタンク18が連通しており、この共通インク室26の他端側には、第2のインク循環供給管28を介してサブタンク14が連通している。また、これら第1および第2のインク循環供給管27、28の途中には、サブタンク14およびバッファタンク18と共通インク室26との連通状態を遮断する開閉弁29、30が介装されている。

【0025】上述した開閉弁22、29、30の構造は全く同一であり、サブタンク14およびバッファタンク18の上端部を抽出拡大した図2および開閉弁22の部分を抽出拡大した図3に示すように、本実施例における開閉弁22は、バッファタンク18の筐体と一体に形成されて直角に折れ曲がる空気給排管21を構成する弁シート部材31と、空気給排管21を開閉し得るベローズ状をなすゴム製の弁体32と、弁シート部材31に接合されて弁体32の外周縁部を弁シート部材31とで挟持

するカバー部材33と、このカバー部材33を貫通し、基端に形成した係止フランジ部34が弁体32に一体的に連結されるプランジャ35と、このプランジャ35の基端側に摺動自在に差し込まれたストッパリング36と、このストッパリング36とカバー部材33との間に介装され、当該ストッパリング36を介してプランジャ35を弁体32と共に空気給排管21を塞ぐように付勢する第1の圧縮コイルばね37と、プランジャ35が摺動自在に貫通する操作板38と、この操作板38と対向するようにプランジャ35の先端側の小径部39に摺動自在に差し込まれた受けスリーブ40と、この受けスリーブ40とプランジャ35の先端に形成したフランジ41との間に介装されて受けスリーブ40を基端側との段部42に付勢する第2の圧縮コイルばね43とを有する。第1の圧縮コイルばね37のばね力は、第2の圧縮コイルばね43のばね力よりも小さく設定されている。

【0026】ここで、操作板38を駆動して図3中、上方に変位させると、まず、操作板38の上面が受けスリーブ40に当接し、次いでばね力が第2の圧縮コイルばね43よりも小さな第1の圧縮コイルばね37が圧縮され、弁体32が空気給排管21を開くが、この第1の圧縮コイルばね37の圧縮は、ストッパリング36がカバー部材33に当接するまで続き、ストッパリング36がカバー部材33に当接して弁体32が最大開度となった後、今度は第2の圧縮コイルばね43の圧縮が始まり、受けスリーブ40が段部42から離れてフランジ41側に押し上げられるが、この場合、弁体32の開度に変化は生じない。

【0027】操作板38は、プランジャ35の軸線に沿って平行移動可能となっており、カバー部材33側に向けて付勢された状態となっている。また、この操作板38の裏面には、図示しない弁駆動モータによって半回転ずつ間欠的に旋回するカム軸44と一体の板カム45が当接しているが、図2からも明らかなように、開閉弁22の開弁状態が他の2つの開閉弁29、30の開弁状態よりも常に長く続くように、他の2つの開閉弁29、30に対応する板カム46とは形状が相違している。

【0028】つまり、図2に示す開弁状態から弁駆動モータによってカム軸44と共に板カム45、46を回転させ始めると、図4に示すようにまず開閉弁22の板カム45が操作板38を押し上げ、開閉弁22が開弁状態に移行する。次いで、図5に示すように残り2つの開閉弁29、30の板カム46が操作板38を押し上げ、これら2つの開閉弁29、30が開弁状態に移行する。逆に、図5に示す開弁状態から閉弁状態に移行する場合には、図4に示すように最初に2つの開閉弁29、30が閉状態に移行し、次いで図3に示すように残りの開閉弁22が閉弁状態に移行するようになっている。

【0029】ただし、板カム46のカムプロフィールを変更することで、最初に開閉弁22を開弁状態から閉弁

させ、次いで2つの開閉弁29、30を開弁状態に移行させることも可能である。

【0030】インクジェットヘッド23の吐出口24が形成される吐出口面47と対向するインク受容部材48と前記サブタンク14とは、インク回収管49を介して連通しており、このインク回収管49の途中には、インク受容部材48内のインク15をサブタンク14側へ送る第2のチューブポンプ50と、インク受容部材48側へのインク15や空気の逆流を防止するための逆止め弁51と、サブタンク14に回収されるインク15中の異物を捕捉するためのフィルタ52とが設けられている。インク受容部材48によるインクジェットヘッド23のキャッピング状態においては、インク受容部材48がインクジェットヘッド23の吐出口24（インク路25）を囲むように、その先端部の弾性変形を伴って吐出口面47に押し当たり、インクジェットヘッド23の吐出口24が密封状態に保持される。予備吐出などによって吐出口24から吐出されるインク滴や、結露などによって吐出口面47に付着した大粒のインク滴は、インク受容部材48内に收容され、第2のチューブポンプ50の作動によってインク回収管49からサブタンク14内に戻される。

【0031】本実施例におけるインク受容部材48は、図示しない受容部材移動装置によって、上述したキャッピング位置と、このキャッピング位置から水平方向に退避した退避位置との間を往復動可能である。

【0032】前記第1および第2のチューブポンプ19、50は、図示しない1台の駆動モータの作動によって同期回転するロータ53と、これらロータ53の外周にそれぞれ回転自在に保持された複数個（図示例ではそれぞれ3個）のローラ54と、インク給排管20、インク回収管49を挟んで各ロータ53を囲む半円弧状の可動チューブ受け55、56と、これら可動チューブ受け55、56をロータ53の半径方向にそれぞれ個別に移動させる図示しない受け駆動手段とを有する。各可動チューブ受け55、56は、受け駆動手段によってロータ53側に前進してインク給排管20、インク回収管49がローラ54によりそれぞれ押しつぶされる操作位置と、可動チューブ受け55、56がインク給排管20、インク回収管49から離れ、これらインク給排管20、インク回収管49がそれぞれ開放状態となる退避位置とに個別に切り換え可能である。

【0033】本実施例におけるインクジェットプリンタには、インク供給モードと、インク循環モードと、予備吐出モードと、プリントモードと、待機モードと、搬送モードとが設定されており、次に、これら各操作モードについて順に説明する。

【0034】インク供給モードは、このインクジェットプリンタの初期状態、あるいはプリント動作やインクジェットヘッド23の回復動作のため、サブタンク14内



に貯蔵されたインク15がプリント可能な下限レベル以下まで消費された場合、インクカートリッジ11からサブタンク14内にインク15を供給したり、あるいはサブタンク14内のインク14とインクカートリッジ11内のインク15とを一定量入れ替えてインク15の成分劣化を平均化するためのものである。

【0035】具体的には、まず第1のチューブポンプ19の可動チューブ受け55を操作位置に切り換え、インク給排管20をローラ54によって押しつぶした後、開閉弁22、29、30を図2に示す開弁状態に切り換える。

【0036】この状態からロータ53を図1中、左回りに駆動回転し、バッファタンク18内のインク15をインク戻し管13を介してインクカートリッジ11内に戻すと、インクカートリッジ11およびサブタンク14内は正圧、バッファタンク18内は負圧となるため、インクカートリッジ11内のインク15がインク供給管17からバッファタンク18内に供給され、インクカートリッジ11ーインク供給管17ーバッファタンク18ーインク給排管20ーサブタンク14ーインク戻し管13ーインクカートリッジ11とつながるインクジェットヘッド23とは独立した密閉循環経路が形成され、インク15はサブタンク14内に上限レベル以上まで蓄積される。

【0037】このインク供給モードの終了後、第1のチューブポンプ19の可動チューブ受け55を退避位置に下降させ、インク給排管20を介してサブタンク14およびバッファタンク18の内圧を等しくし、さらに開閉弁22、29、30を図5に示す開弁状態に切り換える。この場合、最初に空気給排管21が開いてサブタンク14内が大気連通状態となり、これに伴ってバッファタンク18の内圧もサブタンク14と等しくなるため、これに続いて開閉弁29、30が開いても、インクジェットヘッド23の吐出口24からインク15が押し出されたり、逆にこれら吐出口24からインク路25内に空気を吸い込むような不具合を未然に防止することができる。

【0038】インク循環モードは、第1のチューブポンプ19によりインク15をインクジェットヘッド23の共通インク室26に供給し、これをサブタンク14に戻すことにより、インクジェットヘッド23内のインク路25や共通インク室26などの汚損を取り除くためのものである。

【0039】具体的には、まず第1および第2のチューブポンプ19、50の可動チューブ受け55、56を操作位置に上昇させ、インク給排管20、インク回収管49をローラ54によってそれぞれ押しつぶした後、開閉弁22、29、30を図5に示す開弁状態に保持する。この場合、これら開閉弁22、29、30が開弁状態の場合には、先に説明したように、開閉弁22が最初に開

弁状態となり、続いて残りの開閉弁29、30が開弁状態に移行するため、インクジェットヘッド23の吐出口24からインク15が押し出されたり、逆にこれら吐出口24からインク路25内に空気を吸い込むような不具合を未然に防止することができる。

【0040】次に、ロータ53を図1中、右回りに回転駆動し、第1のチューブポンプ19によりサブタンク14内のインク15をバッファタンク18に圧送し、これによってバッファタンク18内のインク15を第1のインク循環供給管27からインクジェットヘッド23の共通インク室26内に供給することにより、その一部がインク路25を介して吐出口24からインク受容部材48に排出され、残りが第2のインク循環供給管28からサブタンク14内に戻される。インク受容部材48に排出されたインク15は、第2のチューブポンプ50によりインク回収管49からサブタンク14内に回収されるが、その途中でフィルタ52によって異物が除去される。

【0041】予備吐出モードは、吐出口24に付着した増粘インクや固化インクによる吐出不良を防止するため、シーケンス制御により、例えば後述するプリントモードに先立って、インクジェットヘッド23のすべての吐出口24からインクをインク受容部材48内に吐出し、これをサブタンク14内に回収するものである。

【0042】具体的には、まず第2のチューブポンプ50の可動チューブ受け56を操作位置に上昇させ、インク回収管49をローラ54によってそれぞれ押しつぶした後、開閉弁22、29、30を図5に示す開弁状態に保持する。この場合、これら開閉弁22、29、30が開弁状態の場合には、先に説明したように、開閉弁22が最初に開弁状態となり、続いて残りの開閉弁29、30が開弁状態に移行するため、インクジェットヘッド23の吐出口24からインク15が押し出されたり、逆にこれら吐出口24からインク路25内に空気を吸い込むような不具合を未然に防止することができる。

【0043】この状態から、インクジェットヘッド23のすべての吐出口24からインク15を吐出すると共にロータ53を図1中、右回りに回転駆動する。この吐出動作に伴って、バッファタンク18内のインク15が第1のインク循環供給管27を介して共通インク室26内に吸引され、同時にサブタンク14内のインクが第2のインク循環供給管28を介して共通インク室26内に吸引される。吐出口24から吐出されたインク15は、キャッピング位置にあるインク受容部材48に受容され、第2のチューブポンプ50によってインク回収管49からサブタンク14内に回収されるが、その途中でフィルタ52により異物が除去される。

【0044】プリントモードは、プリント媒体に対してインクを吐出し、所望の画像を形成するためのものであり、第1および第2のチューブポンプ19、50の可動

チューブ受け55、56をロータ53から離れる退避位置にそれぞれ下降させ、開閉弁22、29、30を図5に示す開弁状態に保持する。この場合、これら開閉弁22、29、30が開弁状態の場合には、先に説明したように、開閉弁22が最初に開弁状態となり、続いて残りの開閉弁29、30が開弁状態に移行するため、インクジェットヘッド23の吐出口24からインク15が押し出されたり、逆にこれら吐出口24からインク路25内に空気を吸い込むような不具合を未然に防止することができる。

【0045】図示しないプリント媒体を図1の紙面に対して垂直な方向に搬送しつつ、個々の吐出口24から選択的にインクを吐出することにより、プリント媒体の表面に所望の画像が形成される。これに伴って消費されるインクの量に応じ、バッファタンク18およびサブタンク14内のインク15が第1および第2のインク循環供給管27、28を介してインクジェットヘッド23に吸引される。

【0046】待機モードは、インクジェットプリンタの電源が切られるなど、ジョブが行われない場合のモードであり、インク15の蒸発をできるだけ防止するため、第1および第2のチューブポンプ19、50の可動チューブ受け55、56をロータ53から離れる退避位置にそれぞれ下降させ、開閉弁22、29、30を図2に示す開弁状態に保持する。これにより、サブタンク14内は密閉状態となり、インク15中の水分の蒸発を未然に防ぐ。

【0047】なお、この待機モード状態にて外気温や気圧に変動があると、サブタンク14やバッファタンク18内のインク15や内圧が変化するが、開閉弁29、30が開弁状態にあるため、その影響がインクジェットヘッド23側へは及ばない。

【0048】輸送モードは、基本的には待機モードと同じ操作状態であるが、インクカートリッジ11がインクジェットプリンタから取り外されているため、開閉弁12は閉弁状態となっている。

【0049】上述した実施例では、板カム45、46のカムプロフィールを変えることで、開閉弁22と開閉弁29、30との開閉タイミングを変えるようにしたが、すべて同一の板カム46を使用しても、開閉弁22と開閉弁29、30との開閉タイミングを変えることが可能である。

【0050】このような本発明の第2の実施例の概略構造を図6～図8に示すが、上述した実施例と同一機能の部材には、これと同一符号を記すに止め、重複する説明は省略するものとする。すなわち、すべての開閉弁22、29、30が開弁状態を表す図6に示すように、開閉弁22の段部42と操作板38の表面との間隔は、他の開閉弁29、30の段部42と操作板38の表面との間隔よりも短く設定されており、操作板38が上昇を始

めると最初に開閉弁22の受けスリーブ40が操作板38に当接し、操作板38のさらなる上昇によって図7に示すように、その第1の圧縮コイルばね37が圧縮されて開閉弁22が開弁状態に移行し、これと並行して開閉弁29、30の受けスリーブ40が操作板38に当接し、操作板38のさらなる上昇によって図8に示すように、これらの第1の圧縮コイルばね37が圧縮されて開閉弁29、30も開弁状態に移行する。

【0051】逆に、図8に示す開弁状態から操作板38が下降を始めると、図7に示すようにまず開閉弁29、30が開弁状態となり、次いで図6に示すように開閉弁22が開弁状態となる。

【0052】このように、本実施例では1枚の操作板38をすべての開閉弁22、29、30に対して共用することができる上、これを複数の板カム46で同時に支持することができるため、先の実施例よりも操作板38の支持機構や昇降機構などを簡略化することができる。また、本実施例では、閉弁状態における開閉弁22の段部42と操作板38との隙間を他の開閉弁29、30のそれよりも小さく設定することによって、開閉弁22と開閉弁29、30との開閉タイミングを変えるようにしたが、第1の実施例における開閉弁29、30の第1の圧縮コイルばね37および第2の圧縮コイルばね43のばね力の関係をそれぞれ逆に設定し、第1の圧縮コイルばね37のばね力を第2の圧縮コイルばね43のばね力よりも大きくすることによっても、開閉弁22と開閉弁29、30との開閉タイミングを変えることが可能である。

【0053】すなわち、開閉弁29、30では操作板38の上昇に伴ってまず第2の圧縮コイルばね43が押し縮められ、受けスリーブ40のみが上昇してフランジ41に当接し、次いで第1の圧縮コイルばね37の圧縮が始まり、フランジ35が弁体32と共に上昇して開閉弁29、30が開弁状態に移行するのに対し、開閉弁22では最初に第1の圧縮コイルばね37の圧縮されるため、上述したように直ちに開閉弁22が開弁状態に移行するようになっている。逆に、これらの開弁状態から閉弁状態への移行の際には、最初に開閉弁29、30が開弁状態に移行した後、開閉弁22が開弁状態に移行する。この実施例の場合、開閉弁29、30のストッパリング36を省略することも可能である。

【0054】図1～図5に示した第1の実施例に対し、開閉弁29、30を省略した第3の実施例について、そのインク供給系を表す図9を参照しながら説明するが、先の実施例と同一機能の部材にはこれと同一符号を記すに止め、重複する説明は省略するものとする。

【0055】すなわち、本実施例では第2のインク循環供給管28の途中に可動チューブ受け57を有する第3のチューブポンプ58を設けており、この第3のチューブポンプ58の吐出能力は、第1のチューブポンプ19

の吐出能力よりも小さく設定されている。この第3のチューブポンプ58は、第1および第2のチューブポンプ19、50と共に、それぞれ独立した駆動源によって個々に駆動可能となっている。また、第2のチューブポンプ50の可動チューブ受けを図示しない固定チューブ受けとし、第2チューブポンプ50に常時ポンプ機能を持たせるようにしている。さらに、第1のインク循環供給管27の途中には、先の実施例の開閉弁に代えてインクジェットヘッド23側からバッファタンク18へのインク15の逆流を阻止する逆止め弁60を介装している。

【0056】本実施例のインク供給モードにおいては、開閉弁22を開弁状態にして第1のチューブポンプ19を駆動することにより、インクカートリッジ11内のインクをバッファタンク18からサブタンク14内に供給する。この時、第3のチューブポンプ58の可動チューブ受け57を操作位置に上昇させ、この可動チューブ受け57とローラ54とで第2インク循環供給管28を押しつぶし、この第2インク循環供給管28を閉止したまましておき、そのローラ59は駆動させない。

【0057】このインク供給モードが終了したならば、開閉弁22を開弁状態に切り換えてサブタンク14内を大気開放した後、第1および第3のチューブポンプ19、58のチューブ受け55、57を共に退避位置に下降させることにより、インク給排管20を介してバッファタンク18およびサブタンク14の内圧を等しくし、さらにインクジェットヘッド23の共通インク室26とサブタンク14内とが第2のインク循環供給管28を介して連通するため、インクジェットヘッド23の吐出口24からインクが溢れ出たり、空気がインク路25内に吸い込まれるような不具合が発生しない。

【0058】なお、チューブポンプ58によってインク循環供給管28を長時間押しつぶし続けることにより、インク順端供給管28が塑性変形してしまうおそれがある場合には、インク供給モードを実行する際に第3のチューブポンプ58の可動チューブ受け57を操作位置に移動させず、退避位置に保持しておき、サブタンク14内の圧力変化をインクジェットヘッド23側に伝播させ、予備吐出モードやインク循環モードでその悪影響を補償するようにしても良い。

【0059】なお、この第3の実施例では開閉弁29、30を共に廃止した場合について説明したが、何れか一方のみを廃止し、第1の実施例1や第2の実施例2に説明した方法とこの第3の実施例による方法とを組み合わせることで、サブタンク14内の大気開放操作と他のインク流路の閉止部分の開放操作とに時間差を設けて対処することも可能である。

【0060】なお、本発明は、特にインクジェット方式の中でも、液体の吐出を行わせるために利用されるエネルギーとして熱エネルギーを発生する手段（例えば、電気熱変換体やレーザ光など）を具え、前記熱エネルギー

により液体の状態変化を生起させる方式のインクジェットプリンタにおいて優れた効果をもたらすものである。かかる方式によれば、プリントの高密度化および高精細化が達成できるからである。

【0061】その代表的な構成や原理については、例えば、米国特許第4723129号明細書や、同第4740796号明細書に開示されている基本的な原理を用いて行うものが好ましい。この方式は、いわゆるオンデマンド型およびコンティニュアス型の何れにも適用可能であるが、特に、オンデマンド型の場合には、液体が保持されているシートや流路に対応して配置される電気熱変換体に、プリント情報に対応して核沸騰を越える急速な温度上昇を与える少なくとも1つの駆動信号を印加することによって、電気熱変換体に熱エネルギーを発生させ、インクジェットヘッドの熱作用面に膜沸騰を生じさせ、結果的にこの駆動信号に一对一に対応した液体内の気泡を形成できるので有効である。この気泡の成長および収縮により、吐出口を介して液体を吐出させ、少なくとも1つの液滴を形成する。この駆動信号をパルス形状とすると、即時適切に気泡の成長収縮が行われるので、特に応答性に優れた液体の吐出が達成でき、より好ましい。このパルス形状の駆動信号としては、米国特許第4463359号明細書や、同第4345262号明細書に記載されているようなものが適している。なお、上記熱作用面の温度上昇率に関する発明の米国特許第4313124号明細書に記載されている条件を採用すると、さらに優れたプリントを行うことができる。

【0062】また、プリントヘッドの構成としては、上述の各明細書に開示されているような吐出口と流路と電気熱変換体との組合せ構成（直線状液流路または直角液流路）の他に、熱作用部が屈曲する領域に配置されている構成を開示する米国特許第4558333号明細書や、米国特許第4459600号明細書を用いた構成も本発明に含まれるものである。加えて、複数の電気熱変換体に対し、共通するスリットを電気熱変換体の吐出部とする構成を開示する特開昭59-123670号公報や、熱エネルギーの圧力波を吸収する開孔を吐出部に対応させる構成を開示した特開昭59-138461号公報に基いた構成としても、本発明の効果は有効である。すなわち、プリントヘッドの形態がどのようなものであっても、本発明によればプリントを確実に効率良く行うことができるようになるからである。

【0063】さらに、上述のようなフルラインタイプのインクジェットヘッドとしては、複数のインクジェットヘッドの組合せによってその長さを満たす構成や、一体的に形成された1個のインクジェットヘッドとしての構成の何れでもよい。加えて、シリアルタイプのインクジェットヘッドが搭載されるインクジェットプリンタの場合でも、本発明は有効である。

【0064】また、搭載されるインクジェットヘッドの

種類や個数についても、例えば単色のインクに対応して1個のみが設けられたものの他、プリント色や濃度を異にする複数のインクに対応して複数個数設けられるものであってもよい。すなわち、例えばインクジェットプリンタのプリントモードとしては黒色などの主流色のみのプリントモードだけではなく、インクジェットヘッドを一体的に構成するか、複数個の組み合わせによるか何れでもよいが、異なる色の複色カラーまたは混色によるフルカラーの各プリントモードの少なくとも一つを備えた装置にも本発明は極めて有効である。この場合、プリント媒体に応じてインクのプリント性を調整するための処理液（プリント性向上液）をインクジェットヘッドからプリント媒体に吐出することも有効である。

【0065】さらに加えて、以上説明した本発明の実施例においては、室温やそれ以下で固化し、室温で軟化もしくは液化するものを用いても良く、あるいはインクジェット方式では液体自体を30℃以上70℃以下の範囲内で温度調整を行って液体の粘性を安定吐出範囲にあるように温度制御するものが一般的であるから、使用プリント信号付与時に液状をなすものを用いてもよい。加えて、熱エネルギーによる昇温を、固形状態から液体状態への状態変化のエネルギーとして使用させることで積極的に防止するため、または液体の蒸発を防止するため、放置状態で固化し加熱によって液化するものを用いてもよい。何れにしても熱エネルギーのプリント信号に応じた付与によって液化し、液体が吐出されるものや、プリント媒体に到達する時点ですでに固化し始めるものなどのような、熱エネルギーの付与によって初めて液化する性質のものを使用する場合も本発明は適用可能である。このような場合の液体は、特開昭54-56847号公報あるいは特開昭60-71260号公報に記載されるような、多孔質シート凹部または貫通孔に液状又は固形物として保持された状態で、電気熱変換体に対して対向するような形態としてもよい。本発明においては、上述した各液体に対して最も有効なものは、上述した膜沸騰方式を実行するものである。

【0066】さらに加えて、本発明にかかる画像形成装置の形態としては、コンピュータなどの情報処理機器の画像出力端末として用いられるものの他、リーダなどと組合せた複写装置、さらには送受信機能を有するファクシミリ装置や捺染装置の形態を採るものなどであっても良い。

【0067】

【発明の効果】本発明によると、大気と連通する大気連通路が設けられたタンクから液体供給通路を介して供給される液体を吐出口から吐出するプリントヘッドを用いてプリント媒体に画像を形成するに際し、大気連通路および液体供給通路が共に閉鎖された状態から、大気連通路を最初に開放した後液体供給通路を開放するようにしたので、まずタンク内が大気開放状態となり、続いて

このタンク内とプリントヘッドとを液体供給通路を介して連通させることができる。この結果、大気連通路および液体供給通路が共に閉鎖された状態におけるタンク側とプリントヘッド側との内圧の相違を大幅に緩和することが可能であり、プリントヘッドの吐出口から液体が溢れ出たり、逆にこの吐出口からプリントヘッド内に空気が吸い込まれるなどの不具合を未然に防止することが可能となり、特別な処理を行わずともプリント品質を良好に維持することができる。

【図面の簡単な説明】

【図1】本発明による画像形成装置をインクジェットプリンタに応用した一実施例におけるインク供給系を表す概念図である。

【図2】図1に示した実施例の主要部を抽出拡大した断面図であり、閉弁状態を表す。

【図3】図1および図2に示した実施例における開閉弁の構造を表す拡大断面図である。

【図4】閉弁状態と開弁状態との間の移行過程での図2に対応した断面図であり、連通路開閉弁のみ開弁状態であることを表す。

【図5】閉弁状態における図2に対応した断面図である。

【図6】本発明の他の実施例における図2に対応した断面図であり、閉弁状態を表す。

【図7】閉弁状態と開弁状態との間の移行過程での図6に対応した断面図であり、連通路開閉弁のみ開弁状態であることを表す。

【図8】閉弁状態における図6に対応した断面図である。

【図9】本発明による別な実施例におけるインク供給系を表す概念図である。

【図10】従来の開閉弁の構造の一例を示す断面図であり、閉弁状態を表す。

【図11】閉弁状態における図10に対応した断面図である。

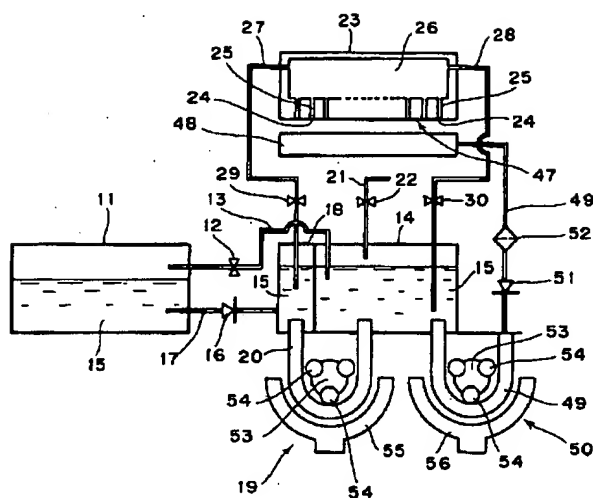
【符号の説明】

- 11 インクカートリッジ
- 12 開閉弁
- 13 インク戻し管
- 14 サブタンク
- 15 インク
- 16 逆止め弁
- 17 インク供給管
- 18 パッファタンク
- 19 第1のチューブポンプ
- 20 インク給排管
- 21 空気給排管
- 22 開閉弁
- 23 インクジェットヘッド
- 24 吐出口

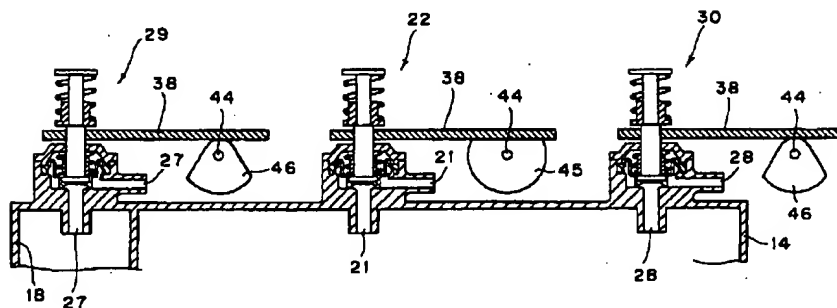
25 インク路  
 26 共通インク室  
 27 第1のインク循環供給管  
 28 第2のインク循環供給管  
 29, 30 開閉弁  
 31 弁シート部材  
 32 弁体  
 33 カバー部材  
 34 係止フランジ部  
 35 プランジヤ  
 36 ストップリング  
 37 第1の圧縮コイルばね  
 38 操作板  
 39 小径部  
 40 受けスリーブ  
 41 フランジ

42 段部  
 43 第2の圧縮コイルばね  
 44 カム軸  
 45, 46 板カム  
 47 吐出口面  
 48 インク受容部材  
 49 インク回収管  
 50 第2のチューブポンプ  
 51 逆止め弁  
 52 フィルタ  
 53 ロータ  
 54 ローラ  
 55~57 可動チューブ受け  
 58 第3のチューブポンプ  
 59 ロータ  
 60 逆止め弁

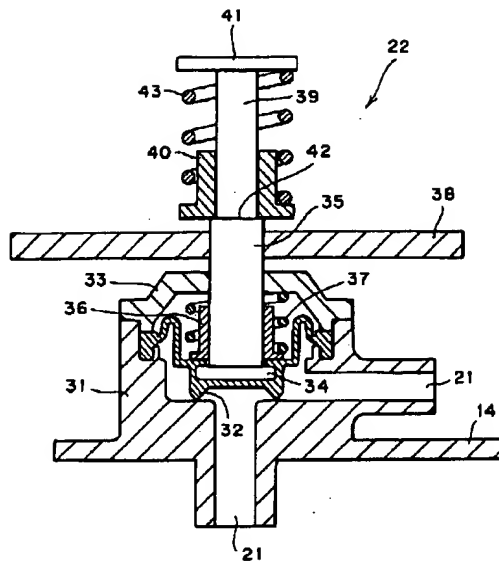
【図1】



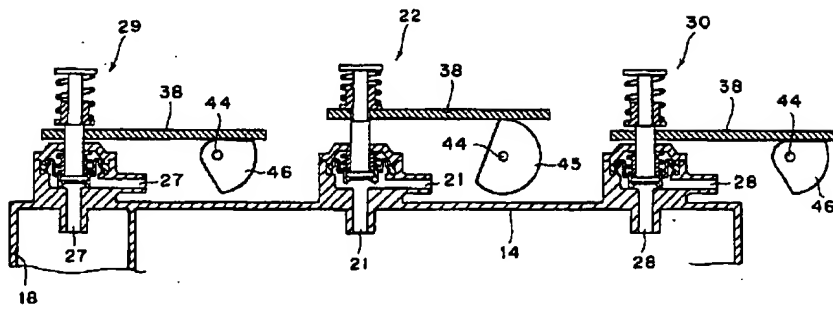
【図2】



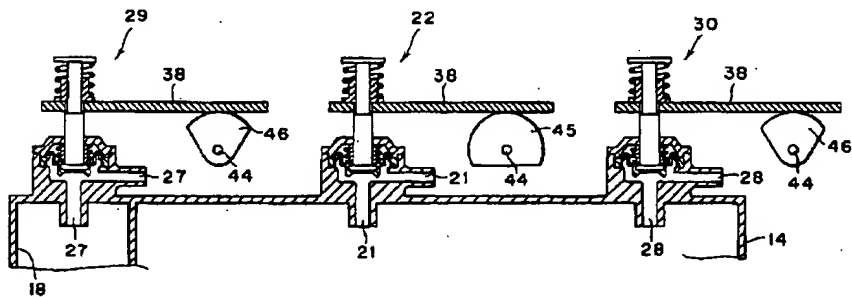
【図3】



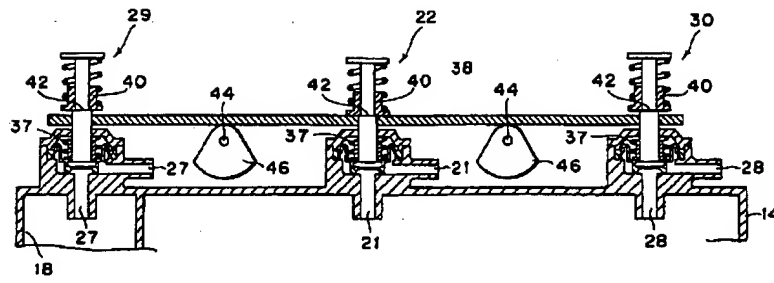
【図4】



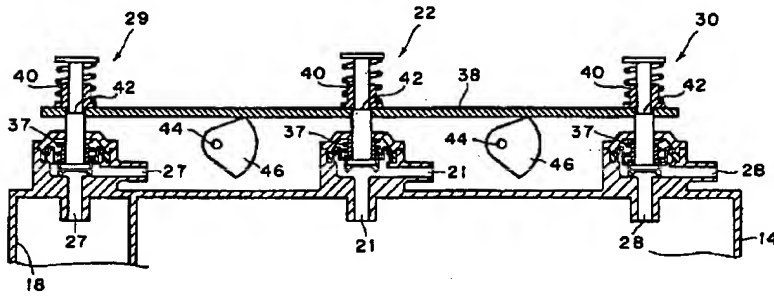
【図5】



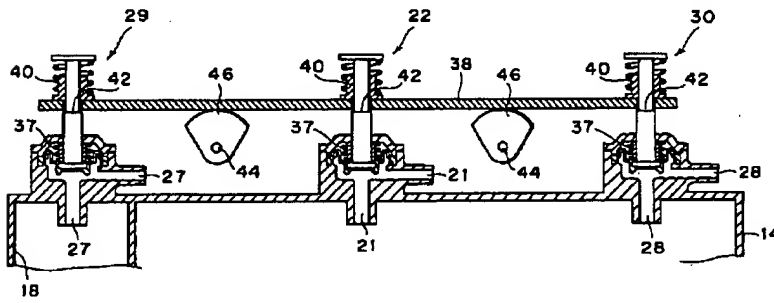
【図6】



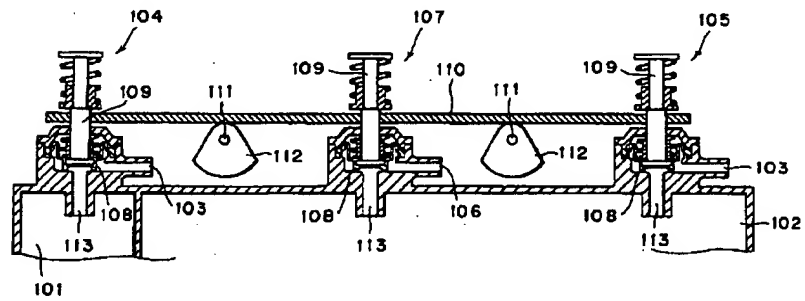
【図7】



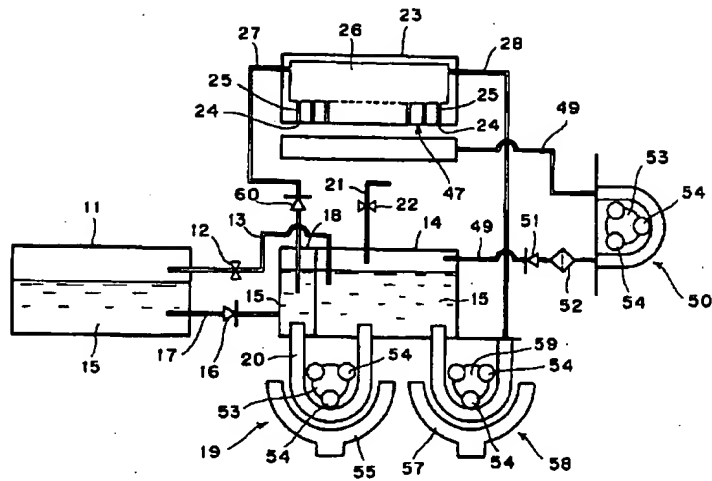
【図8】



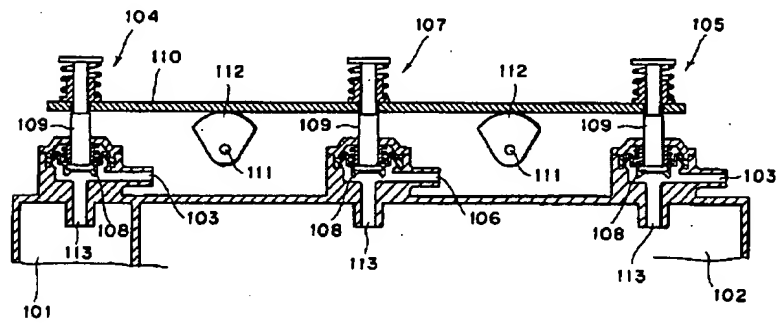
【図10】



【図 9】



【図 11】





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CLAIMS

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## [Claim(s)]

[Claim 1] It is the approach of forming an image in a print medium using the print head which carries out the regurgitation of the liquid supplied through a liquid supply path from a delivery from the tank by which atmospheric air and an atmospheric-air free passage way open for free passage were prepared. The image formation approach characterized by having the step which closes both said atmospheric-air free passage way and said liquid supply path, the step which opens said atmospheric-air free passage way first from this condition, and the step which opens said liquid supply path after opening said atmospheric-air free passage way wide.

[Claim 2] The step which closes both said atmospheric-air free passage way and said liquid supply path is the image formation approach according to claim 1 characterized by performing at the time of the standby to which an image is not formed in said print medium, and power-source OFF.

[Claim 3] Said liquid is the image formation approach according to claim 1 or 2 characterized by being the processing liquid for adjusting the print nature of ink or the ink to said print medium.

[Claim 4] The supply path closing motion means which can open and close the liquid supply path which opens for free passage the tank which stored the liquid supplied to the print head and this print head for breathing out a liquid to a print medium and forming an image, The free passage way closing motion means which can open and close the atmospheric-air free passage way which opens said tank and atmospheric air for free passage, It is image formation equipment which has a closing motion means driving means for performing closing motion of these supply path closing motion means and a free passage way closing motion means. Said closing motion means driving means Image formation equipment characterized by having a differential means by which the switch in the open condition from the closed state of said atmospheric-air free passage way by said free passage way closing motion means is performed in advance of the switch in the open condition from the closed state of said liquid supply path by said supply path closing motion means.

[Claim 5] Said differential means is image formation equipment according to claim 4 characterized by using a cam.

[Claim 6] The supply path closing motion means which can open and close the liquid supply path which opens for free passage the tank which stored the liquid supplied to the print head and this print head for breathing out a liquid to a print medium and forming an image, The 1st closing motion means driving means for opening and closing this supply path closing motion means, The free passage way closing motion means which can open and close the atmospheric-air free passage way which opens said tank and atmospheric air for free passage, It is image formation equipment which has the 2nd closing motion means driving means for opening and closing this free passage way closing motion means. So that the switch in the open condition from the closed state of said atmospheric-air free passage way by said free passage way closing motion means may be performed in advance of the switch in the open condition from the closed state of said liquid supply path by said supply path closing motion means Image formation equipment characterized by having further the control means which controls actuation of said 1st and 2nd closing motion means driving means.

[Claim 7] Image formation equipment according to claim 6 characterized by said free passage way closing motion means and said 1st closing motion means driving means being tube pumps.

[Claim 8] Said print head is image formation equipment given in any of claim 4 to claim 7 characterized by having the regurgitation energy generation section for carrying out the regurgitation of the liquid from said delivery they are.

[Claim 9] Said regurgitation energy generation section is image formation equipment according to claim 8 characterized by having the electric thermal-conversion object which generates heat energy.

[Claim 10] Said delivery of said print head is image formation equipment given in any of claim 4 to claim 9 characterized by having continued and arranged to full [ of the print field of said print medium ] they are.

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## DETAILED DESCRIPTION

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### [Detailed Description of the Invention]

[0001]

[Field of the Invention] Especially this invention is applied to the full line type printer using an ink jet method about the image formation approach and its equipment, and is suitable.

[0002]

[Description of the Prior Art] Since a print head is non-contact to such a print medium, the ink jet printer which forms the image of a request of liquids, such as ink and processing liquid for adjusting the print nature of this ink, to print media, such as the delivery of an ink jet head to discharge, paper, and a resin film or a textile metallurgy group, is excellent in silence, a print rate is quick, a high-density print is possible for it, is easy to colorize, and can mention the advantage of being able to miniaturize the whole equipment.

[0003] The thing using the so-called full line type of the long picture which covered full [ of the image formation field of a print medium ], and arranged the delivery as one of such the ink jet printers of ink jet head is known. In this full line type of ink jet head As compared with the so-called thing of the serial type which a print head scans crosswise [ of a print medium ] Since the output rate of ink is early, the liquid stored by the tank At least two places, For example, it has become general to supply from the both-ends side of the common liquid room which met in the array direction of a delivery, and the closing motion valve for controlling the feeding and discarding of the liquid to an ink jet head is infixed in these supply path, respectively. Moreover, atmospheric air and an atmospheric-air free passage way open for free passage are formed in the tank which stores a liquid, and the free passage way closing motion valve for controlling evaporation of unnecessary moisture from a tank is infixed in it on this atmospheric-air free passage way so that it may take to supply a liquid to an ink jet head from a tank, the inside of a tank may serve as negative pressure and supply of the ink to an ink jet head may not be prevented from a tank.

[0004] The outline structure in the clausilium condition of this conventional closing motion valve is shown in drawing 10 , and the outline structure in the valve-opening condition is shown in drawing 11 . That is, the supply path closing motion valve 104 of the pair which is open for free passage, respectively, 105, and the free passage way closing motion valve 107 that an exit port 106 opens for free passage to atmospheric air are formed in the common liquid room of the ink jet head which an exit port 103 does not illustrate at the upper limit section of the buffer tank 101 and the subtank 102. All of the structure of these three closing motion valves 104, 105, and 107 are the same, and you make it go up and down by rotation of the cam 112 in which the actuation plate 110 which the plunger 109 of a valve element 108 and one penetrates was

attached by the cam shaft 111 of plurality (the example of illustration two), and it bundles up closing motion of a path 113 and performs it.

[0005] The clausilium location which a cam shaft 111 is connected with one driving source which is not illustrated, and shows a cam 112 to drawing 10 , A revolution drive is carried out in the valve-opening location shown in drawing 11 , respectively. The path 113 was closed, respectively at the time of the non-printing activity in the condition of having turned OFF the power source of equipment, and the print activity standby in the condition of having turned ON the power source of equipment etc., and a flow of the liquid from the buffer tank 101 and the subtank 102 is prevented.

[0006]

[Problem(s) to be Solved by the Invention] Drawing 10 , when the liquid of the specified quantity is supplied to the buffer tank 101 and the subtank 102 with the conventional thing shown in drawing 11 from the exchangeable cartridge which is not illustrated, Since all of the closing motion valve 104 mentioned above, 105, and 107 are changed into a clausilium condition and they are performed, If each closing motion valve 104, 105, and 107 are switched to a valve-opening condition when ending a supplement of a liquid and shifting to a print activity Differential pressure may occur to the pressure and atmospheric pressure of the common liquid interior of a room [ pressure / in the buffer tank 101 and the subtank 102 ] of an exit port 103 and the pressure by the side of 106, i.e., an ink jet head.

[0007] Such differential pressure is generated also when there is a difference in the temperature of the liquid stored by the cartridge other than fluctuation, such as an atmospheric pressure and atmospheric temperature, and the temperature of the liquid with which the common liquid interior of a room of an ink jet head was filled up.

[0008] Since the closing motion valve 104, 105, and 107 are switched to a valve-opening condition when similarly the power source was switched on from the closing motion valve 104, 105, and the non-printing working state that holds 107 in the clausilium condition, or also when shifting to a print working state from the closing motion valve 104, 105, and the print activity standby condition of holding 107 in the clausilium condition, the same differential pressure may occur.

[0009] If the pressure in the buffer tank 101 and the subtank 102 is different from the exit port 103 of the closing motion valve 104, 105, and 107, and the pressure by the side of 106 A liquid is extruded from the delivery of an ink jet head, and this adheres to a delivery side. Soil a print medium or Or air will be drawn in an ink jet head from the delivery of an ink jet head, it stops being able to carry out the regurgitation of the liquid normally from a delivery, and, in any case, deterioration of print quality is invited.

[0010]

[Objects of the Invention] The purpose of this invention is to offer the image formation approach that a liquid is extruded from the delivery of a print head, or air is not drawn from the delivery of a print head, and its equipment.

[0011]

[Means for Solving the Problem] The 1st gestalt by this invention is the approach of forming an image in a print medium using the print head which carries out the regurgitation of the liquid supplied through a liquid supply path from a delivery from the tank by which atmospheric air and an atmospheric-air free passage way open for free passage were prepared. It is in the image formation approach characterized by having the step which closes both said atmospheric-air free passage way and said liquid supply path, the step which opens said atmospheric-air free passage

way first from this condition, and the step which opens said liquid supply path after opening said atmospheric-air free passage way wide.

[0012] Moreover, the supply path closing motion means which can open and close the liquid supply path which opens for free passage the tank which stored the liquid supplied to the print head and this print head for the 2nd gestalt by this invention breathing out a liquid to a print medium, and forming an image, The free passage way closing motion means which can open and close the atmospheric-air free passage way which opens said tank and atmospheric air for free passage, It is image formation equipment which has a closing motion means driving means for performing closing motion of these supply path closing motion means and a free passage way closing motion means. Said closing motion means driving means It is in the image formation equipment characterized by having a differential means by which the switch in the open condition from the closed state of said atmospheric-air free passage way by said free passage way closing motion means is performed in advance of the switch in the open condition from the closed state of said liquid supply path by said supply path closing motion means.

[0013] From the condition of according to this invention having operated the supply path closing motion means and the free passage way closing motion means by the closing motion means driving means, and having closed both the liquid supply path and the atmospheric-air free passage way If a supply path closing motion means and a free passage way closing motion means are again operated conversely by the closing motion means driving means The switch in the open condition from the closed state of the atmospheric-air free passage way by the free passage way closing motion means is first performed by the differential means, and after the inside of a tank has changed into an atmospheric-air free passage condition, the switch in the open condition from the closed state of the liquid supply path by the supply path closing motion means is performed.

[0014] Furthermore, the supply path closing motion means which can open and close the liquid supply path which opens for free passage the tank which stored the liquid supplied to the print head and this print head for the 3rd gestalt by this invention breathing out a liquid to a print medium, and forming an image, The 1st closing motion means driving means for opening and closing this supply path closing motion means, The free passage way closing motion means which can open and close the atmospheric-air free passage way which opens said tank and atmospheric air for free passage, It is image formation equipment which has the 2nd closing motion means driving means for opening and closing this free passage way closing motion means. So that the switch in the open condition from the closed state of said atmospheric-air free passage way by said free passage way closing motion means may be performed in advance of the switch in the open condition from the closed state of said liquid supply path by said supply path closing motion means It is in the image formation equipment characterized by having further the control means which controls actuation of said 1st and 2nd closing motion means driving means.

[0015] From the condition of according to this invention having operated the supply path closing motion means and the free passage way closing motion means by the 1st and 2nd closing motion means driving means, and having closed both the liquid supply path and the atmospheric-air free passage way With a control unit, if a supply path closing motion means and a free passage way closing motion means are again operated by the 1st and 2nd closing motion means driving means The switch in the open condition from the closed state of the atmospheric-air free passage way by the free passage way closing motion means is performed first, and after the inside of a tank has changed into an atmospheric-air free passage condition, the switch in the open condition from the closed state of the liquid supply path by the supply path closing motion means is

performed.

[0016]

[Embodiment of the Invention] In the image formation approach by the 1st gestalt of this invention, the step which closes both an atmospheric-air free passage way and a liquid supply path may be performed at the time of the standby to which an image is not formed in a print medium, and power-source OFF. Moreover, a liquid may be the processing liquid for adjusting the print nature of ink or the ink to a print medium.

[0017] In the image formation equipment by the 2nd gestalt of this invention, a differential means may use a cam.

[0018] In the image formation equipment by the 2nd and 3rd gestalten of this invention, a print head may have the regurgitation energy generation section for carrying out the regurgitation of the liquid from a delivery, and the regurgitation energy generation section may have the electric thermal-conversion object which generates heat energy in this case. Moreover, the delivery of a print head may be continued and arranged to full [ of the print field of a print medium ].

[0019] In the image formation equipment by the 3rd gestalt of this invention, a free passage way closing motion means and the 1st closing motion means driving means may be tube pumps.

[0020]

[Example] Although the example which applied the image formation equipment by this invention to the full line type ink jet printer is explained to a detail, referring to drawing 1 - drawing 9, this invention can combine not only an example such but these further, or can apply them also to the technique of other fields which connote the same technical problem.

[0021] As shown in drawing 1 showing the ink supply system in the 1st example, the check valve 16 which is open for free passage with the subtank 14 through the ink return tubing 13 with which the closing motion valve 12 was incorporated on the way, and prevents the back flow of the ink 15 by the side of this ink cartridge 11 is opening for free passage the ink cartridge 11 carried exchangeable on the buffer tank 18 through the ink supply pipe 17 infixed on the way. It is open for free passage through the ink feeding-and-discarding tubing 20 which incorporated the 1st tube pump 19 which this buffer tank 18 and the subtank 14 can reverse [ forward ] on the way, and the ink 15 in the buffer tank 18 is fed by normal rotation actuation of this 1st tube pump 19 at the subtank 14 side.

[0022] The closing motion valve 12 mentioned above is interlocked with attachment-and-detachment actuation of an ink cartridge 11, and opens and closes the ink return tubing 13 automatically. That is, the closing motion valve 12 closed, the ink return tubing 13 is stopped, the closing motion valve 12 opens and an ink cartridge 11 and the subtank 14 are open for free passage in the condition that the ink cartridge 11 is conversely attached in the ink jet printer, through the ink return tubing 13 with the condition that the ink cartridge 11 is removed from the ink jet printer.

[0023] In the upper limit section of the subtank 14, it has the closing motion valve 22 in which an atmospheric-air free passage of the inside of the subtank 14 is possible through the air feeding-and-discarding tubing 21. This closing motion valve 22 takes up the inside of the subtank 14 at the time of un-using [ of this ink jet printer ] it, i.e., storage, when feeding ink 15 on the subtank 14 from an ink cartridge 11, and he is trying to prevent evaporation of the moisture in ink 15 from the subtank 14.

[0024] While the print medium which the ink jet head 23 of this example which covers full [ of the print field of the print medium which is not illustrated ], and many deliveries 24 arrange is the so-called full line type of thing, and is arranged so that the delivery 24 and predetermined

spacing of this ink jet head 23 may be separated and it may counter is conveyed in the perpendicular direction to the space of drawing 1, ink 15 is breathed out from each delivery 24, and a desired image is formed in a print medium. The other end of the ink way 25 where the end became a delivery 24, respectively is in the condition that it was open for free passage in the common ink room 26 formed in this ink jet head 23, the buffer tank 18 is open for free passage through the 1st ink circulation supply pipe 27, and the subtank 14 is open for free passage through the 2nd ink circulation supply pipe 28 to the other end side of this common ink room 26 at the end side of this common ink room 26. Moreover, in the middle of these [ 1st ] and the 2nd ink circulation supply pipe 27, and 28, the closing motion valve 29 which intercepts the free passage condition of the subtank 14 and the buffer tank 18, and the common ink room 26, and 30 are infixed.

[0025] As the parts of drawing 2 which is completely the same as for the structure of the closing motion valve 22 mentioned above, 29, and 30, and carried out extract expansion of the upper limit section of the subtank 14 and the buffer tank 18, and the closing motion valve 22 are shown in drawing 3 which carried out extract expansion The valve sheet member 31 which constitutes the air feeding-and-discarding tubing 21 which the closing motion valve 22 in this example is formed in the housing of the buffer tank 18, and one, and bends at a right angle, The valve element 32 made of rubber which makes the shape of bellows which can open and close the air feeding-and-discarding tubing 21, The covering member 33 which is joined to the valve sheet member 31 and pinches the periphery edge of a valve element 32 by the valve sheet member 31, The plunger 35 with which the stop flange 34 which penetrated this covering member 33 and was formed in the end face is connected with a valve element 32 in one, The stopper ring 36 inserted in the end face side of this plunger 35 free [ sliding ], The 1st compression coil spring 37 which is infixed between this stopper ring 36 and the covering member 33, and energizes a plunger 35 through the stopper ring 36 concerned so that the air feeding-and-discarding tubing 21 may be closed with a valve element 32, The receptacle sleeve 40 inserted for the narrow diameter portion 39 by the side of the tip of a plunger 35, enabling free sliding so that it might counter with the actuation plate 38 which a plunger 35 penetrates free [ sliding ], and this actuation plate 38, It has the 2nd compression coil spring 43 which is infixed between this receptacle sleeve 40 and the flange 41 formed at the tip of a plunger 35, wins popularity, and energizes a sleeve 40 to the step 42 by the side of a end face. The spring force of the 1st compression coil spring 37 is set up smaller than the spring force of the 2nd compression coil spring 43.

[0026] Although the top face of the actuation plate 38 will win popularity, a sleeve 40 will be contacted first, the 1st compression coil spring 37 with the spring force smaller subsequently than the 2nd compression coil spring 43 will be compressed and a valve element 32 will open the air feeding-and-discarding tubing 21 if the actuation plate 38 is driven and the upper part is made to carry out a variation rate among drawing 3 here Compression of this 1st compression coil spring 37 continues until the stopper ring 36 contacts the covering member 33. Although compression of the 2nd compression coil spring 43 starts, and the receptacle sleeve 40 separates from a step 42 and is shortly made a flange 41 side after a valve element 32 serves as [ the stopper ring 36 ] the maximum opening in contact with the covering member 33, change is not produced in the opening of a valve element 32 in this case.

[0027] Along with the axis of a plunger 35, the parallel translation of the actuation plate 38 has become possible, and it is in the condition of having been energized towards the covering member 33 side. Moreover, although the cam shaft 44 which circles on a half-rotation [ every ]

intermittent target with the valve drive motor which is not illustrated, and the plate cam 45 of one are in contact with the rear face of this actuation plate 38 The configuration is different in other two closing motion valves 29 and the plate cam 46 corresponding to 30 so that also from drawing 2, and the valve-opening condition of the closing motion valve 22 may continue always for a long time than other two closing motion valves 29 and the valve-opening condition of 30. [0028] That is, if it begins to rotate a plate cam 45 and 46 with a cam shaft 44 with a valve drive motor from the clausilium condition shown in drawing 2, as shown in drawing 4, the plate cam 45 of the closing motion valve 22 will push up the actuation plate 38 first, and the closing motion valve 22 will shift to a valve-opening condition. Subsequently, it remains, as shown in drawing 5, and two closing motion valves 29 and the plate cam 46 of 30 push up the actuation plate 38, and these two closing motion valves 29 and 30 shift to a valve-opening condition. On the contrary, in shifting to a clausilium condition from the valve-opening condition shown in drawing 5, as shown in drawing 4, two closing motion valves 29 and 30 shift to a closed state first, and the remaining closing motion valve 22 shifts to a clausilium condition so that it may be shown subsequently to drawing 3.

[0029] However, it is possible to carry out clausilium of the closing motion valve 22 from a valve-opening condition first, and to, also make two closing motion valves 29 and 30 shift by changing the cam profile of a plate cam 46 subsequently to a clausilium condition.

[0030] The delivery side 47 in which the delivery 24 of the ink jet head 23 is formed, the ink acceptance member 48 which counters, and said subtank 14 are open for free passage through the ink recovery tubing 49. In the middle of this ink recovery tubing 49 the 2nd tube pump 50 which sends the ink 15 in the ink acceptance member 48 to the subtank 14 side, The check valve 51 for preventing the ink 15 by the side of the ink acceptance member 48 and the back flow of air and the filter 52 for catching the foreign matter in the ink 15 collected by the subtank 14 are formed. In the capping condition of the ink jet head 23 by the ink acceptance member 48, the delivery 24 of per push and the ink jet head 23 is held with the elastic deformation of the point in the delivery side 47 at a seal condition so that the ink acceptance member 48 may surround the delivery 24 (ink way 25) of the ink jet head 23. The ink droplet breathed out by the reserve regurgitation etc. from a delivery 24 and the large ink droplet which adhered to the delivery side 47 by dew condensation etc. are held in the ink acceptance member 48, and is returned in the subtank 14 from the ink recovery tubing 49 by actuation of the 2nd tube pump 50.

[0031] The ink acceptance member 48 in this example can reciprocate between the capping location mentioned above and the evacuation locations horizontally evacuated from this capping location with the acceptance member migration equipment which is not illustrated.

[0032] Said 1st and 2nd tube pumps 19 and 50 Rota 53 which carries out synchronous rotation by actuation of one set of the drive motor which is not illustrated, The roller [ two or more (the example of illustration respectively three pieces) ] 54 held respectively free [ rotation ] at the periphery of these Rota 53, Ink feeding-and-discarding tubing 20, The movable tube receptacle 55 of a semicircle arc which surrounds each Rota 53 on both sides of the ink recovery tubing 49, 56, and these movable tube receptacle 55 and 56 are twisted [ move it according to an individual illustrate it and ] and received in radial [ of Rota 53 ], respectively, and it has a driving means. Each movable tube receptacle 55 and 56 move forward to the Rota 53 side by the receptacle driving means, and are the ink feeding-and-discarding tubing 20, The actuated valve position where the ink recovery tubing 49 is crushed with a roller 54, respectively, and the movable tube receptacle 55 and 56 are the ink feeding-and-discarding tubing 20, It separates from the ink recovery tubing 49, and is these ink feeding-and-discarding tubing 20, It can switch to the



evacuation location where the ink recovery tubing 49 will be in an open condition, respectively according to an individual.

[0033] Ink supply mode, ink circulation mode, reserve regurgitation mode, a printing mode, a standby mode, and conveyance mode are set to the ink jet printer in this example, next each [ these ] operation mode is explained in order.

[0034] When consumed below at the minimum level which can print the ink 15 stored in the subtank 14 for the initial state of this ink jet printer, or print actuation and the recovery action of the ink jet head 23, in order that ink supply mode may supply ink 15 in the subtank 14 from an ink cartridge 11 or may equalize component degradation of constant-rate \*\*\*\*\* ink 15 for the ink 14 in the subtank 14, and the ink 15 in an ink cartridge 11, it is a thing.

[0035] After switching the movable tube receptacle 55 of the 1st tube pump 19 to an actuated valve position first and specifically crushing the ink feeding-and-discarding tubing 20 with a roller 54, the closing motion valve 22, 29, and 30 are switched to the clausilium condition shown in drawing 2.

[0036] If drive rotation of Rota 53 is carried out in the counterclockwise direction among drawing 1 from this condition and the ink 15 in the buffer tank 18 is returned in an ink cartridge 11 through the ink return tubing 13 Since the inside of an ink cartridge 11 and the subtank 14 serves as negative pressure in positive pressure and the buffer tank 18, The ink 15 in an ink cartridge 11 is supplied in the buffer tank 18 from the ink supply pipe 17. The sealing circulation path in which the ink jet head 23 connected with the ink cartridge 11-ink supply pipe 17-buffer tank 18-ink feeding-and-discarding tubing 20-subtank 14-ink return tubing 13-ink cartridge 11 became independent is formed. Ink 15 is accumulated to more than upper limit level into the subtank 14.

[0037] The movable tube receptacle 55 of the 1st tube pump 19 is dropped to an evacuation location after termination in this ink supply mode, internal pressure of the subtank 14 and the buffer tank 18 is made equal through the ink feeding-and-discarding tubing 20, and the closing motion valve 22, 29, and 30 are further switched to the valve-opening condition shown in drawing 5. In this case, fault which the delivery 24 of the ink jet head 23 to ink 15 is extruded, or inhales air in the ink way 25 from these deliveries 24 conversely even if the closing motion valve 29 and 30 open following [ since the air feeding-and-discarding tubing 21 opens first, the inside of the subtank 14 will be in an atmospheric-air free passage condition and it becomes equal / the internal pressure of the buffer tank 18 / to the subtank 14 in connection with this ] this can be prevented beforehand.

[0038] Ink circulation mode is for removing dirt of the ink way 25 in the ink jet head 23, the common ink room 26, etc. by supplying ink 15 to the common ink room 26 of the ink jet head 23 with the 1st tube pump 19, and returning this to the subtank 14.

[0039] The 1st and 2nd tube pumps 19, the movable tube receptacle 55 of 50, and 56 are first raised to an actuated valve position, and, specifically, it is the ink feeding-and-discarding tubing 20, After crushing the ink recovery tubing 49 with a roller 54, respectively, the closing motion valve 22, 29, and 30 are held in the valve-opening condition shown in drawing 5. in this case, when these closing motion valve 22, 29, and 30 are in a clausilium condition Since the closing motion valve 22 will be in a valve-opening condition, follows the beginning and the remaining closing motion valve 29 and 30 shift to a valve-opening condition, as explained previously, Ink 15 can be extruded from the delivery 24 of the ink jet head 23, or fault which inhales air in the ink way 25 from these deliveries 24 conversely can be prevented beforehand.

[0040] Next, carry out the rotation drive of Rota 53 in the clockwise direction among drawing 1,



and the ink 15 in the subtank 14 is fed on the buffer tank 18 with the 1st tube pump 19. By supplying the ink 15 in the buffer tank 18 in the common ink room 26 of the ink jet head 23 from the 1st ink circulation supply pipe 27 by this The part is discharged by the ink acceptance member 48 from a delivery 24 through the ink way 25, and the remainder is returned in the subtank 14 from the 2nd ink circulation supply pipe 28. Although the ink 15 discharged by the ink acceptance member 48 is recovered from the ink recovery tubing 49 by the 2nd tube pump 50 in the subtank 14, a foreign matter is removed by the filter 52 by the middle.

[0041] By sequence control, in advance of the printing mode mentioned later, for example, ink is collected from all the deliveries 24 of the ink jet head 23 in the ink acceptance member 48, and reserve regurgitation mode collects discharge and these in the subtank 14 in order to prevent the poor regurgitation in thickening ink and solidification ink adhering to a delivery 24.

[0042] After raising the movable tube receptacle 56 of the 2nd tube pump 50 to an actuated valve position first and specifically crushing the ink recovery tubing 49 with a roller 54, respectively, the closing motion valve 22, 29, and 30 are held in the valve-opening condition shown in drawing 5 . in this case, when these closing motion valve 22, 29, and 30 are in a clausilium condition Since the closing motion valve 22 will be in a valve-opening condition, follows the beginning and the remaining closing motion valve 29 and 30 shift to a valve-opening condition, as explained previously, Ink 15 can be extruded from the delivery 24 of the ink jet head 23, or fault which inhales air in the ink way 25 from these deliveries 24 conversely can be prevented beforehand.

[0043] From this condition, while carrying out the regurgitation of the ink 15 from all the deliveries 24 of the ink jet head 23, the rotation drive of Rota 53 is carried out in the clockwise direction among drawing 1 . In connection with this discharging, the ink 15 in the buffer tank 18 is attracted in the common ink room 26 through the 1st ink circulation supply pipe 27, and the ink in the subtank 14 is attracted by coincidence in the common ink room 26 through the 2nd ink circulation supply pipe 28. Although the ink 15 breathed out from the delivery 24 is received by the ink acceptance member 48 in a capping location and is recovered from the ink recovery tubing 49 by the 2nd tube pump 50 in the subtank 14, a foreign matter is removed by the filter 52 by the middle.

[0044] A printing mode is a thing in order to form discharge and a desired image for ink to a print medium, drops the 1st and 2nd tube pumps 19, the movable tube receptacle 55 of 50, and 56 to the evacuation location which separates from Rota 53, respectively, and is held in the closing motion valve 22, 29, and the valve-opening condition that shows 30 in drawing 5 . in this case, when these closing motion valve 22, 29, and 30 are in a clausilium condition Since the closing motion valve 22 will be in a valve-opening condition, follows the beginning and the remaining closing motion valve 29 and 30 shift to a valve-opening condition, as explained previously, Ink 15 can be extruded from the delivery 24 of the ink jet head 23, or fault which inhales air in the ink way 25 from these deliveries 24 conversely can be prevented beforehand.

[0045] A desired image is formed in the front face of a print medium by carrying out the regurgitation of the ink alternatively from each delivery 24, conveying the print medium which is not illustrated in the perpendicular direction to the space of drawing 1 . According to the amount of the ink consumed in connection with this, the ink 15 in the buffer tank 18 and the subtank 14 is attracted by the ink jet head 23 through the 1st and 2nd ink circulation supply pipes 27 and 28.

[0046] A standby mode is the mode in case a job -- an ink jet printer is turned off -- is not performed, in order that it may prevent evaporation of ink 15 as much as possible, drops the 1st and 2nd tube pumps 19, the movable tube receptacle 55 of 50, and 56 to the evacuation location

which separates from Rota 53, respectively, and is held in the closing motion valve 22, 29, and the clausilium condition that shows 30 in drawing 2. Thereby, the inside of the subtank 14 will be in a sealing condition, and will prevent evaporation of the moisture in ink 15.

[0047] In addition, if outside air temperature and an atmospheric pressure have fluctuation in the state of this standby mode, ink 15 and internal pressure in the subtank 14 or the buffer tank 18 will change, but since the closing motion valve 29 and 30 are in a clausilium condition, that effect does not attain to the ink jet head 23 side.

[0048] Although transportation mode is in the same actuation condition as a standby mode fundamentally, since the ink cartridge 11 is removed from the ink jet printer, the closing motion valve 12 is in the clausilium condition.

[0049] Although the closing motion valve 22, the closing motion valve 29, and the closing motion timing of 30 were changed by changing a plate cam 45 and the cam profile of 46 in the example mentioned above, even if it uses the same plate cam 46 altogether, it is possible to change the closing motion valve 22, the closing motion valve 29, and the closing motion timing of 30.

[0050] Although the outline structure of the 2nd example of such this invention is shown in drawing 6 - drawing 8, a stop and the overlapping explanation shall be omitted to describe the same sign as this in the member of the same function as the example mentioned above. As shown in all the closing motion valves 22, 29, and drawing 6 to which 30 expresses a clausilium condition, namely, spacing of the step 42 of the closing motion valve 22, and the front face of the actuation plate 38 It is set up shorter than other closing motion valves 29 and spacing of the step 42 of 30, and the front face of the actuation plate 38. As the receptacle sleeve 40 of the closing motion valve 22 contacts the actuation plate 38 first if the actuation plate 38 begins a rise, and the further rise of the actuation plate 38 shows to drawing 7 As the 1st compression coil spring 37 is compressed, the closing motion valve 22 shifts to a valve-opening condition, the closing motion valve 29 and the receptacle sleeve 40 of 30 contact the actuation plate 38 in parallel to this and the further rise of the actuation plate 38 shows to drawing 8 These 1st compression coil spring 37 is compressed, and the closing motion valve 29 and 30 shift to a valve-opening condition.

[0051] On the contrary, if the actuation plate 38 begins descent from the valve-opening condition shown in drawing 8, as shown in drawing 7, the closing motion valve 29 and 30 will be in a clausilium condition first, and the closing motion valve 22 will be in a clausilium condition so that it may be shown subsequently to drawing 6.

[0052] Thus, in this example, when one actuation plate 38 can be shared to all the closing motion valves 22, 29, and 30, since this can be supported to coincidence by two or more plate cams 46, a support device, an elevator style, etc. of the actuation plate 38 can be simplified rather than a previous example. Moreover, although the closing motion valve 22, the closing motion valve 29, and the closing motion timing of 30 were changed in this example by setting up smaller than other closing motion valves 29 and that of 30 the clearance between the steps 42 of the closing motion valve 22 and the actuation plates 38 in a clausilium condition The relation of the spring force of the closing motion valve 29 in the 1st example, the 1st compression coil spring 37 of 30, and the 2nd compression coil spring 43 is set as reverse, respectively. Also by making the spring force of the 1st compression coil spring 37 larger than the spring force of the 2nd compression coil spring 43, it is possible to change the closing motion valve 22, the closing motion valve 29, and the closing motion timing of 30.

[0053] Namely, the 2nd compression coil spring 43 pushes and contracts by the closing motion

valve 29 and 30 first with a rise of the actuation plate 38. Only the receptacle sleeve 40 goes up, contact a flange 41, and, subsequently compression of the 1st compression coil spring 37 starts. Since the 1st compression coil spring 37 is first compressed with the closing motion valve 22 to a plunger 35 going up with a valve element 32, and the closing motion valve 29 and 30 shifting to a valve-opening condition, as mentioned above, the closing motion valve 22 shifts to a valve-opening condition immediately. On the contrary, after the closing motion valve 29 and 30 shift to a clausilium condition first in the case of the shift to a clausilium condition from these valve-opening conditions, the closing motion valve 22 shifts to a clausilium condition. In the case of this example, it is also possible to omit the closing motion valve 29 and the stopper ring 36 of 30.

[0054] Although explained referring to drawing 9 showing the ink supply system about the closing motion valve 29 and the 3rd example which omitted 30 to the 1st example shown in drawing 1 - drawing 5, a stop and the overlapping explanation shall be omitted to describe the same sign as this in the member of the same function as a previous example.

[0055] That is, in this example, the 3rd tube pump 58 which has the movable tube receptacle 57 in the middle of the 2nd ink circulation supply pipe 28 is formed, and the regurgitation capacity of this 3rd tube pump 58 is set up smaller than the regurgitation capacity of the 1st tube pump 19. This 3rd tube pump 58 can be separately driven by the driving source which became independent with the 1st and 2nd tube pumps 19 and 50, respectively. Moreover, he considers as the fixed tube receptacle which does not illustrate the movable tube receptacle of the 2nd tube pump 50, and is trying to always give pumping ability to the 2nd tube pump 50. Furthermore, the check valve 60 which replaces with the closing motion valve of a previous example, and prevents the back flow of the ink 15 to the buffer tank 18 from the ink jet head 23 side in the middle of the 1st ink circulation supply pipe 27 is infixed.

[0056] In the ink supply mode of this example, the ink in an ink cartridge 11 is supplied in the subtank 14 from the buffer tank 18 by changing the closing motion valve 22 into a clausilium condition, and driving the 1st tube pump 19. Raise the movable tube receptacle 57 of the 3rd tube pump 58 to an actuated valve position, and crush the 2nd ink circulation supply pipe 28 with this movable tube receptacle 57 and roller 54, and it carries out by carrying out, with this 2nd ink circulation supply pipe 28 stopped, and that Rota 59 is not made to drive at this time.

[0057] If this ink supply mode is completed, after switching the closing motion valve 22 to a valve-opening condition and carrying out atmospheric-air disconnection of the inside of the subtank 14, By dropping both the tube receptacle 55 of the 1st and 3rd tube pumps 19 and 58, and 57 to an evacuation location In order that internal pressure of the buffer tank 18 and the subtank 14 may be made equal through the ink feeding-and-discarding tubing 20 and the common ink room 26 of the ink jet head 23 and the inside of the subtank 14 may be further open for free passage through the 2nd ink circulation supply pipe 28, Ink does not overflow from the delivery 24 of the ink jet head 23, or fault by which air is inhaled in the ink way 25 does not occur.

[0058] in addition, when there is a possibility that the ink \*\*\*\* supply pipe 28 may deform plastically by continuing carrying out the long duration push grain of the ink circulation supply pipe 28 with the tube pump 58 In case ink supply mode is performed, the movable tube receptacle 57 of the 3rd tube pump 58 is not moved to an actuated valve position. Hold in the evacuation location, the pressure variation in the subtank 14 is made to spread to the ink jet head 23 side, and you may make it compensate the bad influence in reserve regurgitation mode or ink circulation mode.

[0059] In addition, although this 3rd example explained [ both ] the case where the closing

motion valve 29 and 30 were abolished, it is also possible to prepare time difference in the atmospheric-air opening operation in the subtank 14 and the opening operation of the closedown part of other ink passage, and to cope with them by combining the approach which abolished only either and was explained to the 1st example 1 and 2nd example 2, and the approach by this 3rd example.

[0060] In addition, especially this invention is equipped with means (for example, an electric thermal-conversion object, a laser beam, etc.) to generate heat energy as energy used also in an ink jet method in order to make the regurgitation of a liquid perform, and brings about the effectiveness which was excellent in the ink jet printer of the method which makes the change of state of a liquid occur with said heat energy. It is because the densification of a print and highly minute-ization can be attained according to this method.

[0061] About the typical configuration and typical principle, what is performed using the fundamental principle currently indicated by the U.S. Pat. No. 4723129 specification and the 4740796 specification, for example is desirable. Although this method is applicable to both the so-called mold on demand and a continuous system On the electric thermal-conversion object which is especially arranged corresponding to the sheet and passage where the liquid is held in the case of a mold on demand By impressing at least one driving signal which gives the rapid temperature rise which supports print information and exceeds nucleate boiling Since make an electric thermal-conversion object generate heat energy, the heat operating surface of an ink jet head is made to produce film boiling and the air bubbles in the liquid corresponding to this driving signal can be formed by one to one as a result, it is effective. By growth and contraction of these air bubbles, a liquid is made to breathe out through a delivery and at least one drop is formed. If this driving signal is made into the shape of a pulse form, since growth contraction of air bubbles will be performed appropriately instancy, the regurgitation of a liquid excellent in especially responsibility can be attained, and it is more desirable. As a driving signal of the shape of this pulse form, what is indicated by the U.S. Pat. No. 4463359 specification and the 4345262 specification is suitable. In addition, if the conditions indicated by the U.S. Pat. No. 4313124 specification of invention about the rate of a temperature rise of the above-mentioned heat operating surface are adopted, the further excellent print can be performed.

[0062] Moreover, the configuration using the U.S. Pat. No. 4558333 specification which indicates the configuration arranged to the field to which the heat operation section other than a combination configuration (a straight-line-like liquid flow channel or right-angle liquid flow channel) with a delivery, passage, and an electric thermal-conversion object which are indicated by each above-mentioned specification is crooked as a configuration of a print head, and a U.S. Pat. No. 4459600 specification is also included in this invention. In addition, the effectiveness of this invention is effective also as a configuration based on JP,59-123670,A which indicates the configuration which uses a common slit as the discharge part of an electric thermal-conversion object to two or more electric thermal-conversion objects, and JP,59-138461,A which indicated the configuration whose puncturing which absorbs the pressure wave of heat energy is made to correspond to a discharge part. Namely, no matter the gestalt of a print head may be what thing, it is because it can print now efficiently certainly according to this invention.

[0063] Furthermore, as an ink jet head above full line type, any of the configuration which fills the die length with the combination of two or more ink jet heads, and the configuration as one ink jet head formed in one are sufficient. In addition, this invention is effective even when it is the ink jet printer with which the ink jet head of a serial type is carried.

[0064] Moreover, although only one piece was prepared also about the class and the number of

an ink jet head which are carried, for example corresponding to monochromatic ink, corresponding to two or more ink which differs in an others and print color or concentration, more than one may be prepared the number of pieces. That is, this invention is very effective not only in the printing mode of only which mainstream color black, for example as a printing mode of an ink jet printer but equipment equipped with at least one of each of the full color printing mode by the double color color of a color or color mixture which is different in whether an ink jet head is constituted in one, or it is based on two or more combination although any are sufficient. In this case, it is also effective to carry out the regurgitation of the processing liquid (printability improver liquid) for adjusting the print nature of ink according to a print medium to a print medium from an ink jet head.

[0065] Since what carries out temperature control is still more common in addition as it solidifies less than [ a room temperature or it ] in the example of this invention explained above, and what is softened or liquefied at a room temperature may be used, or an ink jet method performs a temperature control for the liquid itself within the limits of 30 degrees C or more 70 degrees C or less and it is in the stabilization regurgitation range about the viscosity of a liquid, what makes the shape of liquid may be used at the time of use print signal grant. In addition, in order to prevent the temperature up by heat energy positively by making it use it as energy of the change of state from a solid condition to a liquid condition, or in order to prevent evaporation of a liquid, what solidifies in the state of neglect and is liquefied with heating may be used. Anyway, it liquefies by grant according to the print signal of heat energy, and this invention can be applied also when using the thing of the property which will not be liquefied without grant of heat energy, such as that by which a liquid is breathed out, and a thing which it already begins to solidify when reaching a print medium. The liquid in such a case is good for a porosity sheet crevice or a through tube which is indicated by JP,54-56847,A or JP,60-71260,A also as liquefied or a gestalt which counters to an electric thermal-conversion object in the condition of having been held as a solid. In this invention, the most effective thing performs the film-boiling method mentioned above to each liquid mentioned above.

[0066] Furthermore, in addition, as a gestalt of the image formation equipment concerning this invention, although used as an image printing terminal of information management systems, such as a computer, the gestalt of the reproducing unit combined with others, a reader, etc., the facsimile apparatus which has a transceiver function further, or textile-printing equipment may be taken.

[0067]

[Effect of the Invention] According to this invention, the liquid supplied through a liquid supply path is faced forming an image in a print medium using the print head which carries out the regurgitation from a delivery from the tank by which atmospheric air and an atmospheric-air free passage way open for free passage were prepared. Since the liquid supply path was opened from the condition that both the atmospheric-air free passage way and the liquid supply path were closed after opening an atmospheric-air free passage way wide first, the inside of a tank will be in an atmospheric-air disconnection condition first, and a print head can be made to open for free passage through a liquid supply path in this tank continuously. Consequently, it is possible to ease sharply a difference of the internal pressure Tanggu in the condition that both the atmospheric air free passage way and the liquid supply path were closed, and by the side of a print head, and a liquid can overflow from the delivery of a print head, or it can become possible to prevent beforehand fault, -- air is conversely inhale in a print head from this delivery --, and special processing cannot be perform, but \*\* can also maintain print quality good.

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 TECHNICAL FIELD
 

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[Field of the Invention] Especially this invention is applied to the full line type printer using an ink jet method about the image formation approach and its equipment, and is suitable.

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 PRIOR ART
 

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[Description of the Prior Art] Since a print head is non-contact to such a print medium, the ink jet printer which forms the image of a request of liquids, such as ink and processing liquid for adjusting the print nature of this ink, to print media, such as the delivery of an ink jet head to discharge, paper, and a resin film or a textile metallurgy group, is excellent in silence, a print rate is quick, a high-density print is possible for it, is easy to colorize, and can mention the advantage of being able to miniaturize the whole equipment.

[0003] The thing using the so-called full line type of the long picture which covered full [ of the image formation field of a print medium ], and arranged the delivery as one of such the ink jet printers of ink jet head is known. In this full line type of ink jet head As compared with the so-called thing of the serial type which a print head scans crosswise [ of a print medium ] Since the output rate of ink is early, the liquid stored by the tank At least two places, For example, it has become general to supply from the both-ends side of the common liquid room which met in the array direction of a delivery, and the closing motion valve for controlling the feeding and discarding of the liquid to an ink jet head is infixed in these supply path, respectively. Moreover, atmospheric air and an atmospheric-air free passage way open for free passage are formed in the tank which stores a liquid, and the free passage way closing motion valve for controlling evaporation of unnecessary moisture from a tank is infixed in it on this atmospheric-air free passage way so that it may take to supply a liquid to an ink jet head from a tank, the inside of a tank may serve as negative pressure and supply of the ink to an ink jet head may not be prevented from a tank.

[0004] The outline structure in the clausilium condition of this conventional closing motion valve is shown in drawing 10 , and the outline structure in the valve-opening condition is shown in drawing 11 . That is, the supply path closing motion valve 104 of the pair which is open for free passage, respectively, 105, and the free passage way closing motion valve 107 that an exit port 106 opens for free passage to atmospheric air are formed in the common liquid room of the ink jet head which an exit port 103 does not illustrate at the upper limit section of the buffer tank 101 and the subtank 102. All of the structure of these three closing motion valves 104, 105, and 107 are the same, and you make it go up and down by rotation of the cam 112 in which the actuation plate 110 which the plunger 109 of a valve element 108 and one penetrates was attached by the cam shaft 111 of plurality (the example of illustration two), and it bundles up closing motion of a path 113 and performs it.

[0005] The clausilium location which a cam shaft 111 is connected with one driving source which is not illustrated, and shows a cam 112 to drawing 10 , A revolution drive is carried out in the valve-opening location shown in drawing 11 , respectively. The path 113 was closed, respectively at the time of the non-printing activity in the condition of having turned OFF the power source of equipment, and the print activity standby in the condition of having turned ON the power source of equipment etc., and a flow of the liquid from the buffer tank 101 and the subtank 102 is prevented.

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## EFFECT OF THE INVENTION

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[Effect of the Invention] According to this invention, mind a liquid supply path from the tank by which atmospheric air and an atmospheric-air free passage way open for free passage were prepared. Since the liquid supply path opened from the condition that faced forming an image in a print medium using the print head which carries out the regurgitation of the liquid supplied from a delivery, and both the atmospheric-air free passage way and the liquid supply path were closed after opening an atmospheric-air free passage way wide first, the inside of a tank will be in an atmospheric-air disconnection condition first, and a print head can make open for free passage through a liquid supply path in this tank continuously. Consequently, it is possible to ease sharply a difference of the internal pressure Tanggu in the condition that both the atmospheric air free passage way and the liquid supply path were closed, and by the side of a print head, and a liquid can overflow from the delivery of a print head, or it can become possible to prevent beforehand fault, -- air is conversely inhale in a print head from this delivery --, and special processing cannot be perform, but \*\* can also maintain print quality good.

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## TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention] Drawing 10 , when the liquid of the specified quantity is supplied to the buffer tank 101 and the subtank 102 with the conventional thing shown in drawing 11 from the exchangeable cartridge which is not illustrated, Since all of the closing motion valve 104 mentioned above, 105, and 107 are changed into a clausilium condition and they are performed, If each closing motion valve 104, 105, and 107 are switched to a valve-opening condition when ending a supplement of a liquid and shifting to a print activity Differential pressure may occur to the pressure and atmospheric pressure of the common liquid interior of a room [ pressure / in the buffer tank 101 and the subtank 102 ] of an exit port 103 and the pressure by the side of 106, i.e., an ink jet head.

[0007] Such differential pressure is generated also when there is a difference in the temperature of the liquid stored by the cartridge other than fluctuation, such as an atmospheric pressure and atmospheric temperature, and the temperature of the liquid with which the common liquid interior of a room of an ink jet head was filled up.

[0008] Since the closing motion valve 104, 105, and 107 are switched to a valve-opening condition when similarly the power source was switched on from the closing motion valve 104, 105, and the non-printing working state that holds 107 in the clausilium condition, or also when shifting to a print working state from the closing motion valve 104, 105, and the print activity standby condition of holding 107 in the clausilium condition, the same differential pressure may occur.

[0009] If the pressure in the buffer tank 101 and the subtank 102 is different from the exit port 103 of the closing motion valve 104, 105, and 107, and the pressure by the side of 106 A liquid is extruded from the delivery of an ink jet head, and this adheres to a delivery side. Soil a print medium or Or air will be drawn in an ink jet head from the delivery of an ink jet head, it stops being able to carry out the regurgitation of the liquid normally from a delivery, and, in any case, deterioration of print quality is invited.

[0010]

[Objects of the Invention] The purpose of this invention is to offer the image formation approach



that a liquid is extruded from the delivery of a print head, or air is not drawn from the delivery of a print head, and its equipment.

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## MEANS

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[Means for Solving the Problem] The 1st gestalt by this invention is the approach of forming an image in a print medium using the print head which carries out the regurgitation of the liquid supplied through a liquid supply path from a delivery from the tank by which atmospheric air and an atmospheric-air free passage way open for free passage were prepared. It is in the image formation approach characterized by having the step which closes both said atmospheric-air free passage way and said liquid supply path, the step which opens said atmospheric-air free passage way first from this condition, and the step which opens said liquid supply path after opening said atmospheric-air free passage way wide.

[0012] Moreover, the supply path closing motion means which can open and close the liquid supply path which opens for free passage the tank which stored the liquid supplied to the print head and this print head for the 2nd gestalt by this invention breathing out a liquid to a print medium, and forming an image, The free passage way closing motion means which can open and close the atmospheric-air free passage way which opens said tank and atmospheric air for free passage, It is image formation equipment which has a closing motion means driving means for performing closing motion of these supply path closing motion means and a free passage way closing motion means. Said closing motion means driving means It is in the image formation equipment characterized by having a differential means by which the switch in the open condition from the closed state of said atmospheric-air free passage way by said free passage way closing motion means is performed in advance of the switch in the open condition from the closed state of said liquid supply path by said supply path closing motion means.

[0013] From the condition of according to this invention having operated the supply path closing motion means and the free passage way closing motion means by the closing motion means driving means, and having closed both the liquid supply path and the atmospheric-air free passage way If a supply path closing motion means and a free passage way closing motion means are again operated conversely by the closing motion means driving means The switch in the open condition from the closed state of the atmospheric-air free passage way by the free passage way closing motion means is first performed by the differential means, and after the inside of a tank has changed into an atmospheric-air free passage condition, the switch in the open condition from the closed state of the liquid supply path by the supply path closing motion means is performed.

[0014] Furthermore, the supply path closing motion means which can open and close the liquid supply path which opens for free passage the tank which stored the liquid supplied to the print head and this print head for the 3rd gestalt by this invention breathing out a liquid to a print medium, and forming an image, The 1st closing motion means driving means for opening and closing this supply path closing motion means, The free passage way closing motion means which can open and close the atmospheric-air free passage way which opens said tank and atmospheric air for free passage, It is image formation equipment which has the 2nd closing motion means driving means for opening and closing this free passage way closing motion means. So that the switch in the open condition from the closed state of said atmospheric-air free passage way by said free passage way closing motion means may be performed in advance of the switch in the open condition from the closed state of said liquid supply path by said supply path



closing motion means It is in the image formation equipment characterized by having further the control means which controls actuation of said 1st and 2nd closing motion means driving means. [0015] From the condition of according to this invention having operated the supply path closing motion means and the free passage way closing motion means by the 1st and 2nd closing motion means driving means, and having closed both the liquid supply path and the atmospheric-air free passage way With a control unit, if a supply path closing motion means and a free passage way closing motion means are again operated by the 1st and 2nd closing motion means driving means The switch in the open condition from the closed state of the atmospheric-air free passage way by the free passage way closing motion means is performed first, and after the inside of a tank has changed into an atmospheric-air free passage condition, the switch in the open condition from the closed state of the liquid supply path by the supply path closing motion means is performed.

[0016]

[Embodiment of the Invention] In the image formation approach by the 1st gestalt of this invention, the step which closes both an atmospheric-air free passage way and a liquid supply path may be performed at the time of the standby to which an image is not formed in a print medium, and power-source OFF. Moreover, a liquid may be the processing liquid for adjusting the print nature of ink or the ink to a print medium.

[0017] In the image formation equipment by the 2nd gestalt of this invention, a differential means may use a cam.

[0018] In the image formation equipment by the 2nd and 3rd gestalten of this invention, a print head may have the regurgitation energy generation section for carrying out the regurgitation of the liquid from a delivery, and the regurgitation energy generation section may have the electric thermal-conversion object which generates heat energy in this case. Moreover, the delivery of a print head may be continued and arranged to full [ of the print field of a print medium ].

[0019] In the image formation equipment by the 3rd gestalt of this invention, a free passage way closing motion means and the 1st closing motion means driving means may be tube pumps.

## EXAMPLE

[Example] Although the example which applied the image formation equipment by this invention to the full line type ink jet printer is explained to a detail, referring to drawing 1 - drawing 9 , this invention can combine not only an example such but these further, or can apply them also to the technique of other fields which connote the same technical problem.

[0021] As shown in drawing 1 showing the ink supply system in the 1st example, the check valve 16 which is open for free passage with the subtank 14 through the ink return tubing 13 with which the closing motion valve 12 was incorporated on the way, and prevents the back flow of the ink 15 by the side of this ink cartridge 11 is opening for free passage the ink cartridge 11 carried exchangeable on the buffer tank 18 through the ink supply pipe 17 infixed on the way. It is open for free passage through the ink feeding-and-discarding tubing 20 which incorporated the 1st tube pump 19 which this buffer tank 18 and the subtank 14 can reverse [ forward ] on the way, and the ink 15 in the buffer tank 18 is fed by normal rotation actuation of this 1st tube pump 19 at the subtank 14 side.

[0022] The closing motion valve 12 mentioned above is interlocked with attachment-and-detachment actuation of an ink cartridge 11, and opens and closes the ink return tubing 13 automatically. That is, the closing motion valve 12 closed, the ink return tubing 13 is stopped,

the closing motion valve 12 opens and an ink cartridge 11 and the subtank 14 are open for free passage in the condition that the ink cartridge 11 is conversely attached in the ink jet printer, through the ink return tubing 13 with the condition that the ink cartridge 11 is removed from the ink jet printer.

[0023] In the upper limit section of the subtank 14, it has the closing motion valve 22 in which an atmospheric-air free passage of the inside of the subtank 14 is possible through the air feeding-and-discarding tubing 21. This closing motion valve 22 takes up the inside of the subtank 14 at the time of un-using [ of this ink jet printer ] it, i.e., storage, when feeding ink 15 on the subtank 14 from an ink cartridge 11, and he is trying to prevent evaporation of the moisture in ink 15 from the subtank 14.

[0024] While the print medium which the ink jet head 23 of this example which covers full [ of the print field of the print medium which is not illustrated ], and many deliveries 24 arrange is the so-called full line type of thing, and is arranged so that the delivery 24 and predetermined spacing of this ink jet head 23 may be separated and it may counter is conveyed in the perpendicular direction to the space of drawing 1, ink 15 is breathed out from each delivery 24, and a desired image is formed in a print medium. The other end of the ink way 25 where the end became a delivery 24, respectively is in the condition that it was open for free passage in the common ink room 26 formed in this ink jet head 23, the buffer tank 18 is open for free passage through the 1st ink circulation supply pipe 27, and the subtank 14 is open for free passage through the 2nd ink circulation supply pipe 28 to the other end side of this common ink room 26 at the end side of this common ink room 26. Moreover, in the middle of these [ 1st ] and the 2nd ink circulation supply pipe 27, and 28, the closing motion valve 29 which intercepts the free passage condition of the subtank 14 and the buffer tank 18, and the common ink room 26, and 30 are infixed.

[0025] As the parts of drawing 2 which is completely the same as for the structure of the closing motion valve 22 mentioned above, 29, and 30, and carried out extract expansion of the upper limit section of the subtank 14 and the buffer tank 18, and the closing motion valve 22 are shown in drawing 3 which carried out extract expansion The valve sheet member 31 which constitutes the air feeding-and-discarding tubing 21 which the closing motion valve 22 in this example is formed in the housing of the buffer tank 18, and one, and bends at a right angle, The valve element 32 made of rubber which makes the shape of bellows which can open and close the air feeding-and-discarding tubing 21, The covering member 33 which is joined to the valve sheet member 31 and pinches the periphery edge of a valve element 32 by the valve sheet member 31, The plunger 35 with which the stop flange 34 which penetrated this covering member 33 and was formed in the end face is connected with a valve element 32 in one, The stopper ring 36 inserted in the end face side of this plunger 35 free [ sliding ], The 1st compression coil spring 37 which is infixed between this stopper ring 36 and the covering member 33, and energizes a plunger 35 through the stopper ring 36 concerned so that the air feeding-and-discarding tubing 21 may be closed with a valve element 32, The receptacle sleeve 40 inserted for the narrow diameter portion 39 by the side of the tip of a plunger 35, enabling free sliding so that it might counter with the actuation plate 38 which a plunger 35 penetrates free [ sliding ], and this actuation plate 38, It has the 2nd compression coil spring 43 which is infixed between this receptacle sleeve 40 and the flange 41 formed at the tip of a plunger 35, wins popularity, and energizes a sleeve 40 to the step 42 by the side of a end face. The spring force of the 1st compression coil spring 37 is set up smaller than the spring force of the 2nd compression coil spring 43.

[0026] Although the top face of the actuation plate 38 will win popularity, a sleeve 40 will be contacted first, the 1st compression coil spring 37 with the spring force smaller subsequently than the 2nd compression coil spring 43 will be compressed and a valve element 32 will open the air feeding-and-discarding tubing 21 if the actuation plate 38 is driven and the upper part is made to carry out a variation rate among drawing 3 here Compression of this 1st compression coil spring 37 continues until the stopper ring 36 contacts the covering member 33. Although compression of the 2nd compression coil spring 43 starts, and the receptacle sleeve 40 separates from a step 42 and is shortly made a flange 41 side after a valve element 32 serves as [ the stopper ring 36 ] the maximum opening in contact with the covering member 33, change is not produced in the opening of a valve element 32 in this case.

[0027] Along with the axis of a plunger 35, the parallel translation of the actuation plate 38 has become possible, and it is in the condition of having been energized towards the covering member 33 side. Moreover, although the cam shaft 44 which circles on a half-rotation [ every ] intermittent target with the valve drive motor which is not illustrated, and the plate cam 45 of one are in contact with the rear face of this actuation plate 38 The configuration is different in other two closing motion valves 29 and the plate cam 46 corresponding to 30 so that also from drawing 2 , and the valve-opening condition of the closing motion valve 22 may continue always for a long time than other two closing motion valves 29 and the valve-opening condition of 30.

[0028] That is, if it begins to rotate a plate cam 45 and 46 with a cam shaft 44 with a valve drive motor from the clausilium condition shown in drawing 2 , as shown in drawing 4 , the plate cam 45 of the closing motion valve 22 will push up the actuation plate 38 first, and the closing motion valve 22 will shift to a valve-opening condition. Subsequently, it remains, as shown in drawing 5 , and two closing motion valves 29 and the plate cam 46 of 30 push up the actuation plate 38, and these two closing motion valves 29 and 30 shift to a valve-opening condition. On the contrary, in shifting to a clausilium condition from the valve-opening condition shown in drawing 5 , as shown in drawing 4 , two closing motion valves 29 and 30 shift to a closed state first, and the remaining closing motion valve 22 shifts to a clausilium condition so that it may be shown subsequently to drawing 3 .

[0029] However, it is possible to carry out clausilium of the closing motion valve 22 from a valve-opening condition first, and to, also make two closing motion valves 29 and 30 shift by changing the cam profile of a plate cam 46 subsequently to a clausilium condition.

[0030] The delivery side 47 in which the delivery 24 of the ink jet head 23 is formed, the ink acceptance member 48 which counters, and said subtank 14 Are open for free passage through the ink recovery tubing 49. In the middle of this ink recovery tubing 49 The 2nd tube pump 50 which sends the ink 15 in the ink acceptance member 48 to the subtank 14 side, The check valve 51 for preventing the ink 15 by the side of the ink acceptance member 48 and the back flow of air and the filter 52 for catching the foreign matter in the ink 15 collected by the subtank 14 are formed. In the capping condition of the ink jet head 23 by the ink acceptance member 48, the delivery 24 of per push and the ink jet head 23 is held with the elastic deformation of the point in the delivery side 47 at a seal condition so that the ink acceptance member 48 may surround the delivery 24 (ink way 25) of the ink jet head 23. The ink droplet breathed out by the reserve regurgitation etc. from a delivery 24 and the large ink droplet which adhered to the delivery side 47 by dew condensation etc. are held in the ink acceptance member 48, and is returned in the subtank 14 from the ink recovery tubing 49 by actuation of the 2nd tube pump 50.

[0031] The ink acceptance member 48 in this example can reciprocate between the capping location mentioned above and the evacuation locations horizontally evacuated from this capping

location with the acceptance member migration equipment which is not illustrated.

[0032] Said 1st and 2nd tube pumps 19 and 50 Rota 53 which carries out synchronous rotation by actuation of one set of the drive motor which is not illustrated, The roller [ two or more (the example of illustration respectively three pieces) ] 54 held respectively free [ rotation ] at the periphery of these Rota 53, Ink feeding-and-discarding tubing 20, The movable tube receptacle 55 of a semicircle arc which surrounds each Rota 53 on both sides of the ink recovery tubing 49, 56, and these movable tube receptacle 55 and 56 are twisted [ move it according to an individual illustrate it and ] and received in radial [ of Rota 53 ], respectively, and it has a driving means. Each movable tube receptacle 55 and 56 move forward to the Rota 53 side by the receptacle driving means, and are the ink feeding-and-discarding tubing 20, The actuated valve position where the ink recovery tubing 49 is crushed with a roller 54, respectively, and the movable tube receptacle 55 and 56 are the ink feeding-and-discarding tubing 20, It separates from the ink recovery tubing 49, and is these ink feeding-and-discarding tubing 20, It can switch to the evacuation location where the ink recovery tubing 49 will be in an open condition, respectively according to an individual.

[0033] Ink supply mode, ink circulation mode, reserve regurgitation mode, a printing mode, a standby mode, and conveyance mode are set to the ink jet printer in this example, next each [ these ] operation mode is explained in order.

[0034] When consumed below at the minimum level which can print the ink 15 stored in the subtank 14 for the initial state of this ink jet printer, or print actuation and the recovery action of the ink jet head 23, in order that ink supply mode may supply ink 15 in the subtank 14 from an ink cartridge 11 or may equalize component degradation of constant-rate \*\*\*\*\* ink 15 for the ink 14 in the subtank 14, and the ink 15 in an ink cartridge 11, it is a thing.

[0035] After switching the movable tube receptacle 55 of the 1st tube pump 19 to an actuated valve position first and specifically crushing the ink feeding-and-discarding tubing 20 with a roller 54, the closing motion valve 22, 29, and 30 are switched to the clausilium condition shown in drawing 2 .

[0036] If drive rotation of Rota 53 is carried out in the counterclockwise direction among drawing 1 from this condition and the ink 15 in the buffer tank 18 is returned in an ink cartridge 11 through the ink return tubing 13 Since the inside of an ink cartridge 11 and the subtank 14 serves as negative pressure in positive pressure and the buffer tank 18, The ink 15 in an ink cartridge 11 is supplied in the buffer tank 18 from the ink supply pipe 17. The sealing circulation path in which the ink jet head 23 connected with the ink cartridge 11-ink supply pipe 17-buffer tank 18-ink feeding-and-discarding tubing 20-subtank 14-ink return tubing 13-ink cartridge 11 became independent is formed. Ink 15 is accumulated to more than upper limit level into the subtank 14.

[0037] The movable tube receptacle 55 of the 1st tube pump 19 is dropped to an evacuation location after termination in this ink supply mode, internal pressure of the subtank 14 and the buffer tank 18 is made equal through the ink feeding-and-discarding tubing 20, and the closing motion valve 22, 29, and 30 are further switched to the valve-opening condition shown in drawing 5 . In this case, fault which the delivery 24 of the ink jet head 23 to ink 15 is extruded, or inhales air in the ink way 25 from these deliveries 24 conversely even if the closing motion valve 29 and 30 open following [ since the air feeding-and-discarding tubing 21 opens first, the inside of the subtank 14 will be in an atmospheric-air free passage condition and it becomes equal / the internal pressure of the buffer tank 18 / to the subtank 14 in connection with this ] this can be prevented beforehand.

[0038] Ink circulation mode is for removing dirt of the ink way 25 in the ink jet head 23, the common ink room 26, etc. by supplying ink 15 to the common ink room 26 of the ink jet head 23 with the 1st tube pump 19, and returning this to the subtank 14.

[0039] The 1st and 2nd tube pumps 19, the movable tube receptacle 55 of 50, and 56 are first raised to an actuated valve position, and, specifically, it is the ink feeding-and-discarding tubing 20, After crushing the ink recovery tubing 49 with a roller 54, respectively, the closing motion valve 22, 29, and 30 are held in the valve-opening condition shown in drawing 5 . in this case, when these closing motion valve 22, 29, and 30 are in a clausilium condition Since the closing motion valve 22 will be in a valve-opening condition, follows the beginning and the remaining closing motion valve 29 and 30 shift to a valve-opening condition, as explained previously, Ink 15 can be extruded from the delivery 24 of the ink jet head 23, or fault which inhales air in the ink way 25 from these deliveries 24 conversely can be prevented beforehand.

[0040] Next, carry out the rotation drive of Rota 53 in the clockwise direction among drawing 1 , and the ink 15 in the subtank 14 is fed on the buffer tank 18 with the 1st tube pump 19. By supplying the ink 15 in the buffer tank 18 in the common ink room 26 of the ink jet head 23 from the 1st ink circulation supply pipe 27 by this The part is discharged by the ink acceptance member 48 from a delivery 24 through the ink way 25, and the remainder is returned in the subtank 14 from the 2nd ink circulation supply pipe 28. Although the ink 15 discharged by the ink acceptance member 48 is recovered from the ink recovery tubing 49 by the 2nd tube pump 50 in the subtank 14, a foreign matter is removed by the filter 52 by the middle.

[0041] By sequence control, in advance of the printing mode mentioned later, for example, ink is collected from all the deliveries 24 of the ink jet head 23 in the ink acceptance member 48, and reserve regurgitation mode collects discharge and these in the subtank 14 in order to prevent the poor regurgitation in thickening ink and solidification ink adhering to a delivery 24.

[0042] After raising the movable tube receptacle 56 of the 2nd tube pump 50 to an actuated valve position first and specifically crushing the ink recovery tubing 49 with a roller 54, respectively, the closing motion valve 22, 29, and 30 are held in the valve-opening condition shown in drawing 5 . in this case, when these closing motion valve 22, 29, and 30 are in a clausilium condition Since the closing motion valve 22 will be in a valve-opening condition, follows the beginning and the remaining closing motion valve 29 and 30 shift to a valve-opening condition, as explained previously, Ink 15 can be extruded from the delivery 24 of the ink jet head 23, or fault which inhales air in the ink way 25 from these deliveries 24 conversely can be prevented beforehand.

[0043] From this condition, while carrying out the regurgitation of the ink 15 from all the deliveries 24 of the ink jet head 23, the rotation drive of Rota 53 is carried out in the clockwise direction among drawing 1 . In connection with this discharging, the ink 15 in the buffer tank 18 is attracted in the common ink room 26 through the 1st ink circulation supply pipe 27, and the ink in the subtank 14 is attracted by coincidence in the common ink room 26 through the 2nd ink circulation supply pipe 28. Although the ink 15 breathed out from the delivery 24 is received by the ink acceptance member 48 in a capping location and is recovered from the ink recovery tubing 49 by the 2nd tube pump 50 in the subtank 14, a foreign matter is removed by the filter 52 by the middle.

[0044] A printing mode is a thing in order to form discharge and a desired image for ink to a print medium, drops the 1st and 2nd tube pumps 19, the movable tube receptacle 55 of 50, and 56 to the evacuation location which separates from Rota 53, respectively, and is held in the closing motion valve 22, 29, and the valve-opening condition that shows 30 in drawing 5 . in this

case, when these closing motion valve 22, 29, and 30 are in a clausilium condition Since the closing motion valve 22 will be in a valve-opening condition, follows the beginning and the remaining closing motion valve 29 and 30 shift to a valve-opening condition, as explained previously, Ink 15 can be extruded from the delivery 24 of the ink jet head 23, or fault which inhales air in the ink way 25 from these deliveries 24 conversely can be prevented beforehand.

[0045] A desired image is formed in the front face of a print medium by carrying out the regurgitation of the ink alternatively from each delivery 24, conveying the print medium which is not illustrated in the perpendicular direction to the space of drawing 1 . According to the amount of the ink consumed in connection with this, the ink 15 in the buffer tank 18 and the subtank 14 is attracted by the ink jet head 23 through the 1st and 2nd ink circulation supply pipes 27 and 28.

[0046] A standby mode is the mode in case a job -- an ink jet printer is turned off -- is not performed, in order that it may prevent evaporation of ink 15 as much as possible, drops the 1st and 2nd tube pumps 19, the movable tube receptacle 55 of 50, and 56 to the evacuation location which separates from Rota 53, respectively, and is held in the closing motion valve 22, 29, and the clausilium condition that shows 30 in drawing 2 . Thereby, the inside of the subtank 14 will be in a sealing condition, and will prevent evaporation of the moisture in ink 15.

[0047] In addition, if outside air temperature and an atmospheric pressure have fluctuation in the state of this standby mode, ink 15 and internal pressure in the subtank 14 or the buffer tank 18 will change, but since the closing motion valve 29 and 30 are in a clausilium condition, that effect does not attain to the ink jet head 23 side.

[0048] Although transportation mode is in the same actuation condition as a standby mode fundamentally, since the ink cartridge 11 is removed from the ink jet printer, the closing motion valve 12 is in the clausilium condition.

[0049] Although the closing motion valve 22, the closing motion valve 29, and the closing motion timing of 30 were changed by changing a plate cam 45 and the cam profile of 46 in the example mentioned above, even if it uses the same plate cam 46 altogether, it is possible to change the closing motion valve 22, the closing motion valve 29, and the closing motion timing of 30.

[0050] Although the outline structure of the 2nd example of such this invention is shown in drawing 6 - drawing 8 , a stop and the overlapping explanation shall be omitted to describe the same sign as this in the member of the same function as the example mentioned above. As shown in all the closing motion valves 22, 29, and drawing 6 to which 30 expresses a clausilium condition, namely, spacing of the step 42 of the closing motion valve 22, and the front face of the actuation plate 38 It is set up shorter than other closing motion valves 29 and spacing of the step 42 of 30, and the front face of the actuation plate 38. As the receptacle sleeve 40 of the closing motion valve 22 contacts the actuation plate 38 first if the actuation plate 38 begins a rise, and the further rise of the actuation plate 38 shows to drawing 7 As the 1st compression coil spring 37 is compressed, the closing motion valve 22 shifts to a valve-opening condition, the closing motion valve 29 and the receptacle sleeve 40 of 30 contact the actuation plate 38 in parallel to this and the further rise of the actuation plate 38 shows to drawing 8 These 1st compression coil spring 37 is compressed, and the closing motion valve 29 and 30 shift to a valve-opening condition.

[0051] On the contrary, if the actuation plate 38 begins descent from the valve-opening condition shown in drawing 8 , as shown in drawing 7 , the closing motion valve 29 and 30 will be in a clausilium condition first, and the closing motion valve 22 will be in a clausilium condition so that it may be shown subsequently to drawing 6 .

[0052] Thus, in this example, when one actuation plate 38 can be shared to all the closing motion valves 22, 29, and 30, since this can be supported to coincidence by two or more plate cams 46, a support device, an elevator style, etc. of the actuation plate 38 can be simplified rather than a previous example. Moreover, although the closing motion valve 22, the closing motion valve 29, and the closing motion timing of 30 were changed in this example by setting up smaller than other closing motion valves 29 and that of 30 the clearance between the steps 42 of the closing motion valve 22 and the actuation plates 38 in a clausilium condition. The relation of the spring force of the closing motion valve 29 in the 1st example, the 1st compression coil spring 37 of 30, and the 2nd compression coil spring 43 is set as reverse, respectively. Also by making the spring force of the 1st compression coil spring 37 larger than the spring force of the 2nd compression coil spring 43, it is possible to change the closing motion valve 22, the closing motion valve 29, and the closing motion timing of 30.

[0053] Namely, the 2nd compression coil spring 43 pushes and contracts by the closing motion valve 29 and 30 first with a rise of the actuation plate 38. Only the receptacle sleeve 40 goes up, contact a flange 41, and, subsequently compression of the 1st compression coil spring 37 starts. Since the 1st compression coil spring 37 is first compressed with the closing motion valve 22 to a plunger 35 going up with a valve element 32, and the closing motion valve 29 and 30 shifting to a valve-opening condition, as mentioned above, the closing motion valve 22 shifts to a valve-opening condition immediately. On the contrary, after the closing motion valve 29 and 30 shift to a clausilium condition first in the case of the shift to a clausilium condition from these valve-opening conditions, the closing motion valve 22 shifts to a clausilium condition. In the case of this example, it is also possible to omit the closing motion valve 29 and the stopper ring 36 of 30.

[0054] Although explained referring to drawing 9 showing the ink supply system about the closing motion valve 29 and the 3rd example which omitted 30 to the 1st example shown in drawing 1 - drawing 5, a stop and the overlapping explanation shall be omitted to describe the same sign as this in the member of the same function as a previous example.

[0055] That is, in this example, the 3rd tube pump 58 which has the movable tube receptacle 57 in the middle of the 2nd ink circulation supply pipe 28 is formed, and the regurgitation capacity of this 3rd tube pump 58 is set up smaller than the regurgitation capacity of the 1st tube pump 19. This 3rd tube pump 58 can be separately driven by the driving source which became independent with the 1st and 2nd tube pumps 19 and 50, respectively. Moreover, he considers as the fixed tube receptacle which does not illustrate the movable tube receptacle of the 2nd tube pump 50, and is trying to always give pumping ability to the 2nd tube pump 50. Furthermore, the check valve 60 which replaces with the closing motion valve of a previous example, and prevents the back flow of the ink 15 to the buffer tank 18 from the ink jet head 23 side in the middle of the 1st ink circulation supply pipe 27 is infixed.

[0056] In the ink supply mode of this example, the ink in an ink cartridge 11 is supplied in the subtank 14 from the buffer tank 18 by changing the closing motion valve 22 into a clausilium condition, and driving the 1st tube pump 19. Raise the movable tube receptacle 57 of the 3rd tube pump 58 to an actuated valve position, and crush the 2nd ink circulation supply pipe 28 with this movable tube receptacle 57 and roller 54, and it carries out by carrying out, with this 2nd ink circulation supply pipe 28 stopped, and that Rota 59 is not made to drive at this time.

[0057] If this ink supply mode is completed, after switching the closing motion valve 22 to a valve-opening condition and carrying out atmospheric-air disconnection of the inside of the subtank 14, By dropping both the tube receptacle 55 of the 1st and 3rd tube pumps 19 and 58, and 57 to an evacuation location In order that internal pressure of the buffer tank 18 and the



subtank 14 may be made equal through the ink feeding-and-discarding tubing 20 and the common ink room 26 of the ink jet head 23 and the inside of the subtank 14 may be further open for free passage through the 2nd ink circulation supply pipe 28, Ink does not overflow from the delivery 24 of the ink jet head 23, or fault by which air is inhaled in the ink way 25 does not occur.

[0058] in addition, when there is a possibility that the ink \*\*\*\* supply pipe 28 may deform plastically by continuing carrying out the long duration push grain of the ink circulation supply pipe 28 with the tube pump 58 In case ink supply mode is performed, the movable tube receptacle 57 of the 3rd tube pump 58 is not moved to an actuated valve position. Hold in the evacuation location, the pressure variation in the subtank 14 is made to spread to the ink jet head 23 side, and you may make it compensate the bad influence in reserve regurgitation mode or ink circulation mode.

[0059] In addition, although this 3rd example explained [ both ] the case where the closing motion valve 29 and 30 were abolished, it is also possible to prepare time difference in the atmospheric-air opening operation in the subtank 14 and the opening operation of the closedown part of other ink passage, and to cope with them by combining the approach which abolished only either and was explained to the 1st example 1 and 2nd example 2, and the approach by this 3rd example.

[0060] In addition, especially this invention is equipped with means (for example, an electric thermal-conversion object, a laser beam, etc.) to generate heat energy as energy used also in an ink jet method in order to make the regurgitation of a liquid perform, and brings about the effectiveness which was excellent in the ink jet printer of the method which makes the change of state of a liquid occur with said heat energy. It is because the densification of a print and highly minute-ization can be attained according to this method.

[0061] About the typical configuration and typical principle, what is performed using the fundamental principle currently indicated by the U.S. Pat. No. 4723129 specification and the 4740796 specification, for example is desirable. Although this method is applicable to both the so-called mold on demand and a continuous system On the electric thermal-conversion object which is especially arranged corresponding to the sheet and passage where the liquid is held in the case of a mold on demand By impressing at least one driving signal which gives the rapid temperature rise which supports print information and exceeds nucleate boiling Since make an electric thermal-conversion object generate heat energy, the heat operating surface of an ink jet head is made to produce film boiling and the air bubbles in the liquid corresponding to this driving signal can be formed by one to one as a result, it is effective. By growth and contraction of these air bubbles, a liquid is made to breathe out through a delivery and at least one drop is formed. If this driving signal is made into the shape of a pulse form, since growth contraction of air bubbles will be performed appropriately instancy, the regurgitation of a liquid excellent in especially responsibility can be attained, and it is more desirable. As a driving signal of the shape of this pulse form, what is indicated by the U.S. Pat. No. 4463359 specification and the 4345262 specification is suitable. In addition, if the conditions indicated by the U.S. Pat. No. 4313124 specification of invention about the rate of a temperature rise of the above-mentioned heat operating surface are adopted, the further excellent print can be performed.

[0062] Moreover, the configuration using the U.S. Pat. No. 4558333 specification which indicates the configuration arranged to the field to which the heat operation section other than a combination configuration (a straight-line-like liquid flow channel or right-angle liquid flow channel) with a delivery, passage, and an electric thermal-conversion object which are indicated



by each above-mentioned specification is crooked as a configuration of a print head, and a U.S. Pat. No. 4459600 specification is also included in this invention. In addition, the effectiveness of this invention is effective also as a configuration based on JP,59-123670,A which indicates the configuration which uses a common slit as the discharge part of an electric thermal-conversion object to two or more electric thermal-conversion objects, and JP,59-138461,A which indicated the configuration whose puncturing which absorbs the pressure wave of heat energy is made to correspond to a discharge part. Namely, no matter the gestalt of a print head may be what thing, it is because it can print now efficiently certainly according to this invention.

[0063] Furthermore, as an ink jet head above full line type, any of the configuration which fills the die length with the combination of two or more ink jet heads, and the configuration as one ink jet head formed in one are sufficient. In addition, this invention is effective even when it is the ink jet printer with which the ink jet head of a serial type is carried.

[0064] Moreover, although only one piece was prepared also about the class and the number of an ink jet head which are carried, for example corresponding to monochromatic ink, corresponding to two or more ink which differs in an others and print color or concentration, more than one may be prepared the number of pieces. That is, this invention is very effective not only in the printing mode of only which mainstream color black, for example as a printing mode of an ink jet printer but equipment equipped with at least one of each of the full color printing mode by the double color color of a color or color mixture which is different in whether an ink jet head is constituted in one, or it is based on two or more combination although any are sufficient. In this case, it is also effective to carry out the regurgitation of the processing liquid (printability improver liquid) for adjusting the print nature of ink according to a print medium to a print medium from an ink jet head.

[0065] Since what carries out temperature control is still more common in addition as it solidifies less than [ a room temperature or it ] in the example of this invention explained above, and what is softened or liquefied at a room temperature may be used, or an ink jet method performs a temperature control for the liquid itself within the limits of 30 degrees C or more 70 degrees C or less and it is in the stabilization regurgitation range about the viscosity of a liquid, what makes the shape of liquid may be used at the time of use print signal grant. In addition, in order to prevent the temperature up by heat energy positively by making it use it as energy of the change of state from a solid condition to a liquid condition, or in order to prevent evaporation of a liquid, what solidifies in the state of neglect and is liquefied with heating may be used. Anyway, it liquefies by grant according to the print signal of heat energy, and this invention can be applied also when using the thing of the property which will not be liquefied without grant of heat energy, such as that by which a liquid is breathed out, and a thing which it already begins to solidify when reaching a print medium. The liquid in such a case is good for a porosity sheet crevice or a through tube which is indicated by JP,54-56847,A or JP,60-71260,A also as liquefied or a gestalt which counters to an electric thermal-conversion object in the condition of having been held as a solid. In this invention, the most effective thing performs the film-boiling method mentioned above to each liquid mentioned above.

[0066] Furthermore, in addition, as a gestalt of the image formation equipment concerning this invention, although used as an image printing terminal of information management systems, such as a computer, the gestalt of the reproducing unit combined with others, a reader, etc., the facsimile apparatus which has a transceiver function further, or textile-printing equipment may be taken.

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## DESCRIPTION OF DRAWINGS

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### [Brief Description of the Drawings]

[Drawing 1] It is a conceptual diagram showing the ink supply system in one example which applied the image formation equipment by this invention to the ink jet printer.

[Drawing 2] It is the sectional view which carried out extract expansion of the principal part of the example shown in drawing 1 , and a clausilium condition is expressed.

[Drawing 3] It is an expanded sectional view showing the structure of the closing motion valve in the example shown in drawing 1 and drawing 2 .

[Drawing 4] It is a sectional view corresponding to drawing 2 in the shift process between a clausilium condition and a valve-opening condition, and expresses that only a free passage way closing motion valve is in a valve-opening condition.

[Drawing 5] It is a sectional view corresponding to drawing 2 in a clausilium condition.

[Drawing 6] It is a sectional view corresponding to drawing 2 in other examples of this invention, and a clausilium condition is expressed.

[Drawing 7] It is a sectional view corresponding to drawing 6 in the shift process between a clausilium condition and a valve-opening condition, and expresses that only a free passage way closing motion valve is in a valve-opening condition.

[Drawing 8] It is a sectional view corresponding to drawing 6 in a clausilium condition.

[Drawing 9] It is a conceptual diagram showing the ink supply system in another example by this invention.

[Drawing 10] It is the sectional view showing an example of the structure of the conventional closing motion valve, and a clausilium condition is expressed.

[Drawing 11] It is a sectional view corresponding to drawing 10 in a clausilium condition.

### [Description of Notations]

- 11 Ink Cartridge
- 12 Closing Motion Valve
- 13 Ink Return Tubing
- 14 SubTank
- 15 Ink
- 16 Check Valve
- 17 Ink Supply Pipe
- 18 Buffer Tank
- 19 1st Tube Pump
- 20 Ink Feeding-and-Discarding Tubing
- 21 Air Feeding-and-Discarding Tubing
- 22 Closing Motion Valve
- 23 Ink Jet Head
- 24 Delivery
- 25 Ink Way
- 26 Common Ink Room
- 27 1st Ink Circulation Supply Pipe
- 28 2nd Ink Circulation Supply Pipe
- 29 30 Closing motion valve
- 31 Valve Sheet Member
- 32 Valve Element

33 Covering Member  
34 Stop Flange  
35 Plunger  
36 Stopper Ring  
37 1st Compression Coil Spring  
38 Actuation Plate  
39 Narrow Diameter Portion  
40 Receptacle Sleeve  
41 Flange  
42 Step  
43 2nd Compression Coil Spring  
44 Cam Shaft  
45 46 Plate cam  
47 Delivery Side  
48 Ink Acceptance Member  
49 Ink Recovery Tubing  
50 2nd Tube Pump  
51 Check Valve  
52 Filter  
53 Rota  
54 Roller  
55-57 Movable tube receptacle  
58 3rd Tube Pump  
59 Rota  
60 Check Valve

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[Translation done.]